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Toft, Henrik Stensgaard; Sørensen, John Dalsgaard

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by

Henrik Stensgaard Toft
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Introduction

The main aim of the present report is to establish stochastic models for the uncertainties related to fatigue design of composite materials. The uncertainties considered are the physical uncertainty related to the static and fatigue strength and the model uncertainty related to Miners rule for linear damage accumulation. Test data analyzed are taken from the Optimat database [1] which is public available. The composite material tested within the Optimat project is normally used for wind turbine blades.

Composite materials differ from many other materials because the mean stress has a significant influence on the fatigue strength. Modelling of the fatigue strength for composite material has been considered in e.g. [2-5]. Normally the effect of the mean stress is taken into account by estimating SN-curves for different *R*-ratio's and arranging these in a constant life diagram. The *R*-ratio is defined by:

$$R = \frac{\sigma_{\min}}{\sigma_{\max}} \tag{1}$$

where σ_{min} and σ_{max} are the minimum and maximum stress in a fatigue cycle, respectively. Several different constant life diagrams have been proposed in the literature. However, in this report only the full constant life diagram has been considered where all available SN-curves at different *R*-ratio's are taken into account.

Fatigue failure for variable amplitude loading is normally estimated using Miners rule for linear damage accumulation [6]. Fatigue failure is defined to occur when the accumulated damage D sums to unity:

$$D = \sum_{i=1}^{n} \frac{1}{N\left(\Delta\sigma_i\right)} \tag{2}$$

where $\Delta\sigma_i$ is the stress range for cycle number i and $N(\Delta\sigma_i)$ is the allowable number of cycles with this stress range. n corresponds to the total number of stress cycles. In [7-9] different algorithms for fatigue damage accumulation have been compared. The results show that Miners rule in general is non-conservative. However, more complicated models e.g. based on the residual strength approach do in general not lead to significantly better results.

The fatigue tests considered in this report are performed with the geometries R03UD2 and R04MD2 from the Optimat database [1]. R03UD2 is a unidirectional laminate with lay-up $[0°]_4$ E-glass woven mats with epoxy resin. R04MD2 is a multidirectional laminate with lay-up $[[\pm 45,0°]_4; \pm 45]$ E-glass woven mats with epoxy resin. The two geometries have been chosen for this study because a large number of tests are performed with these geometries which allows for a detailed statistical analysis of the data.

The fatigue strength given by a constant life diagram is in this report estimated from static tests and constant amplitude fatigue tests. The uncertainty on Miners rule for linear damage accumulation is estimated from variable amplitude fatigue tests. The variable amplitude fatigue tests are performed using the Wisper and Wisperx spectra [10;11] developed for representing the flap bending moment of a wind turbine blade, see figure 1. The two spectra are supposed to give the same damage but the time series with the Wisperx spectrum is approximately 10 times shorter than the corresponding one with the Wisper spectrum, see table 1.

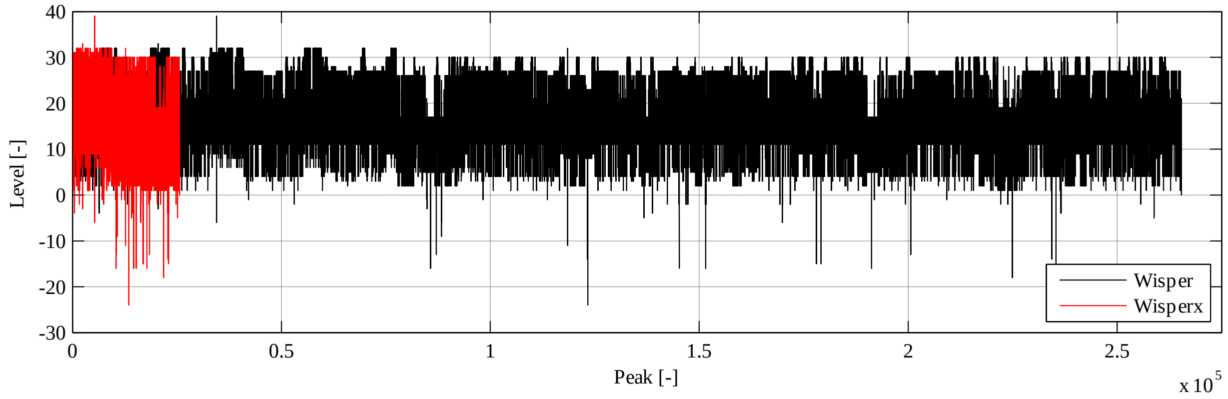

Figure 1: Wisper and Wisperx spectrum.

Table 1: Summary of Wisper and Wisperx spectra.

Spectrum	Min.	Max.	No. of cycles	No. of peaks
Wisper	-24	39	132711	265423
Wisperx	-24	39	12831	25663

In the following section the methods used for analysing the tests are described. In the subsequent sections the results and conclusion are presented. The tests from the Optimat database used in this report are shown in appendix.

Method

In the literature different SN-curves for composite material have been considered see e.g. [7]. In the present study a log-log SN-curve is assumed to model the number of cycles to failure:

$$\log N = \log K - m \log \Delta\sigma + \varepsilon \tag{3}$$

where N is the number of cycles to failure, $\Delta\sigma$ is the stress range and ε is a parameter which model the lack of fit and is assumed normal distributed with mean value zero and standard deviation σ_ε. The constants K and m are material parameters. By assuming that the residuals are normal distributed on a log-log scale the likelihood function in case of n constant amplitude tests from which n_0 are run-outs is given by:

$$\begin{aligned} L(\log K, \sigma_\varepsilon) = \prod_{i=1}^{n-n_0} \frac{1}{\sqrt{2\pi}\sigma_\varepsilon} \exp\left(-\frac{1}{2} \left(\frac{\log N_i - (\log K - m \log \Delta\sigma_i)}{\sigma_\varepsilon} \right)^2 \right) \cdot \\ \prod_{i=n-n_0+1}^{n} \Phi\left(\frac{\log N_i - (\log K - m \log \Delta\sigma_i)}{\sigma_\varepsilon} \right) \end{aligned} \tag{4}$$

where N_i and $\Delta\sigma_i$ is the number of cycles to failure and stress range for test specimen number i respectively. The parameter m is determined by least square method and the parameters log$K$ and σ_ε are estimated using the Maximum-Likelihood Method where the optimization problem $\max_{\log K, \sigma_\varepsilon} L(\log K, \sigma_\varepsilon)$ is solved using a standard nonlinear optimizer, e.g. the NLPQL algorithm [12]. In this report m is assumed fixed determined by the least square method, but this parameter could also be included in the optimization. Since the parameters log$K$ and σ_ε are estimated by the Maximum-Likelihood technique they become asymptotically Normal distributed stochastic variables with expected values equal to the Maximum-Likelihood estimators and covariance equal to, see e.g. [13]:

$$C_{\log K, \sigma_\varepsilon} = \left[-H_{\log K, \sigma_\varepsilon} \right]^{-1} = \begin{bmatrix} \sigma_{\log K}^2 & \rho_{\log K, \sigma_\varepsilon} \sigma_{\log K} \sigma_{\sigma_\varepsilon} \\ \rho_{\log K, \sigma_\varepsilon} \sigma_{\log K} \sigma_{\sigma_\varepsilon} & \sigma_{\sigma_\varepsilon}^2 \end{bmatrix} \tag{5}$$

where $H_{\log K, \sigma_\varepsilon}$ is the Hessian matrix with second order derivatives of the log-Likelihood function. $\sigma_{\log K}$ and $\sigma_{\sigma_\varepsilon}$ denote the standard deviation on log$K$ and σ_ε respectively. $\rho_{\log K, \sigma_\varepsilon}$ is the correlation coefficient between log$K$ and σ_ε. The Hessian matrix is estimated by numerical differentiation. It is noted that σ_ε represents the physical uncertainty and that $\sigma_{\log K}$ and $\sigma_{\sigma_\varepsilon}$ represents the statistical uncertainty.

In deterministic fatigue design characteristic SN-curves are used in the design process. For composite material used for wind turbine blades the characteristic SN-curve is defined as the 5% quantile with a confidence level on 95% according to IEC 61400-1 and DNV [14;15]. The characteristic SN-curve is characterized by a characteristic value of log$K$ which can be determined from:

$$\log K_c = \log K - k_s \sigma_\varepsilon \tag{6}$$

where k_s is a parameter dependent on the quantile, confidence level and number of tests through the non-central *t*-distribution (statistical uncertainty is implicitly taken into account). σ_ε is the physical uncertainty on the SN-curve. The characteristic SN-curve is in this report also estimated for $k_s = k_\infty = 1.645$ by which the statistical uncertainty is not taken into account. A similar approach is used for the static strengths.

The model uncertainty on Miners rule for linear damage accumulation is estimated by calculating the accumulated damage at failure for each variable amplitude fatigue test. The time series tested is analyzed by Rainflow-counting and the damage from each stress cycles is estimated using Miners rule for linear damage accumulation and the constant life diagram. In order to calculate the damage for arbitrary *R*-ratio's a linear interpolation in the constant life diagram is used given by the following procedure, see figure 2 [14].

- The stress cycle P is located in the constant life diagram
- Draw a line a from the origin through and beyond the point P
- Identify the constant life lines closest to P, denoted n_1 and n_2
- Calculate the length a_1 on line a between the two constant life lines n_1 and n_2
- Calculate the length a_2 on line a between point P and the constant life line n_2
- Find the R-ratio closest to P and calculate the length b_1 between n_1 and n_2
- Calculate $b_2 = \frac{b_1 a_2}{a_1}$
- Determine the stress amplitude σ_{CLD} corresponding to point Q
- Determine the expected number of cycles to failure N using the SN-curve for the *R*-ratio

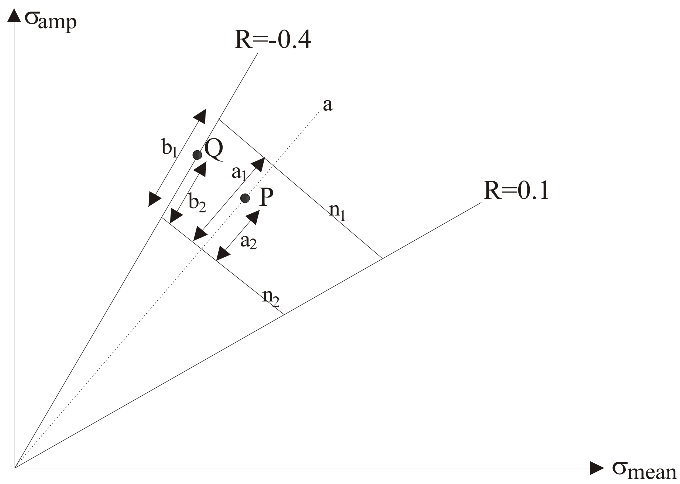

Figure 2: Linear interpolation in constant life diagram.

Based on the estimated damage at failure for each variable amplitude fatigue test the mean and standard deviation are calculated in order to establish a stochastic model for the model uncertainty on Miners rule.

Results

In the following the results for geometry R03UD2 and R04MD2 are given. The estimated static tension and compression strength for the two geometries are shown in table 2 and the corresponding characteristic values are given in table 3. Histograms of the tests are shown in figure 3-6 and the datasets used are shown in appendix 1 and 2.

Table 2: Estimated static tension and compression strength for geometry R03UD2 and R04MD2.

Geometry	Test type	Tests n	Mean [MPa]	Std. [MPa]	CoV
R03UD2	Tension	103	832.5	88.0	0.11
R03UD2	Compression	79	-500.5	59.6	0.12
R04MD2	Tension	66	556.5	64.2	0.12
R04MD2	Compression	55	-458.6	33.2	0.07

Table 3: Characteristic static tension and compression strength for geometry R03UD2 and R04MD2.

Geometry	Test type	k_s	Char. [MPa] (with stat. unc.)	k_∞	Char. [MPa] (without stat. unc.)
R03UD2	Tension	1.922	663.3	1.645	687.7
R03UD2	Compression	1.967	-383.3	1.645	-402.5
R04MD2	Tension	2.002	428.0	1.645	450.9
R04MD2	Compression	2.042	-390.7	1.645	-403.9

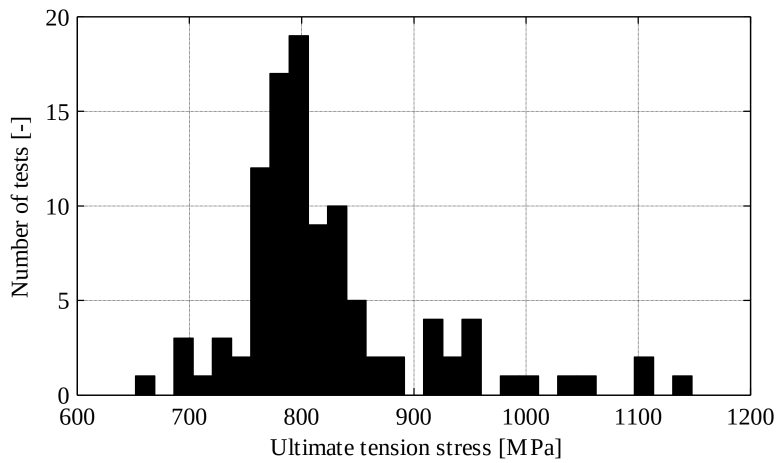

Figure 3: Histogram for static tension strength geometry R03UD2.

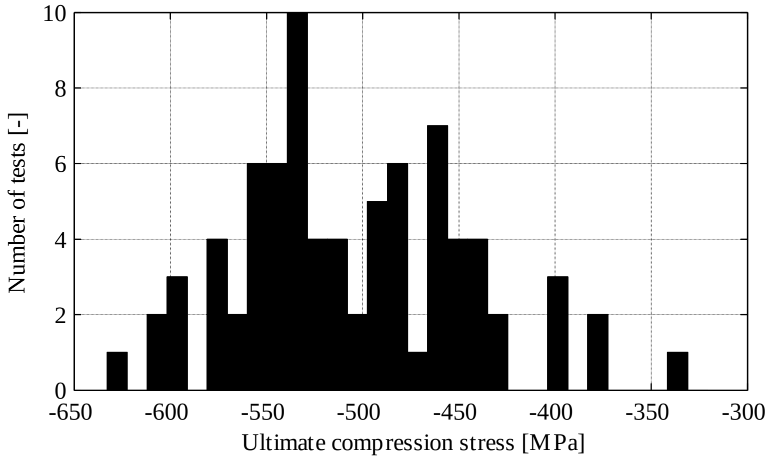

Figure 4: Histogram for static compression strength geometry R03UD2.

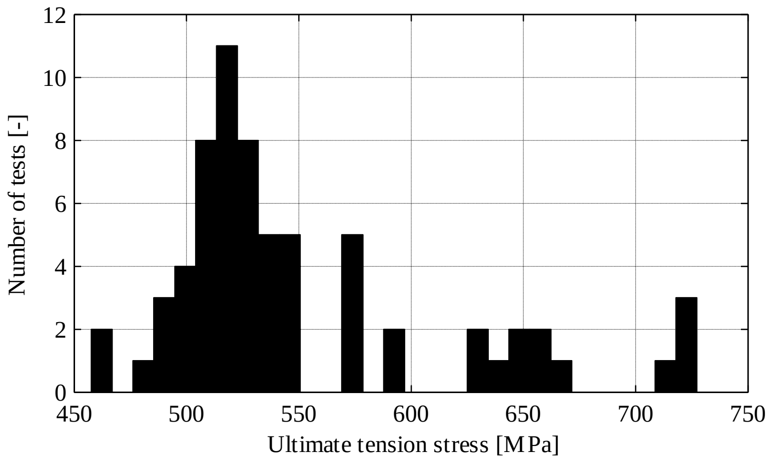

Figure 5: Histogram for static tension strength geometry R04MD2.

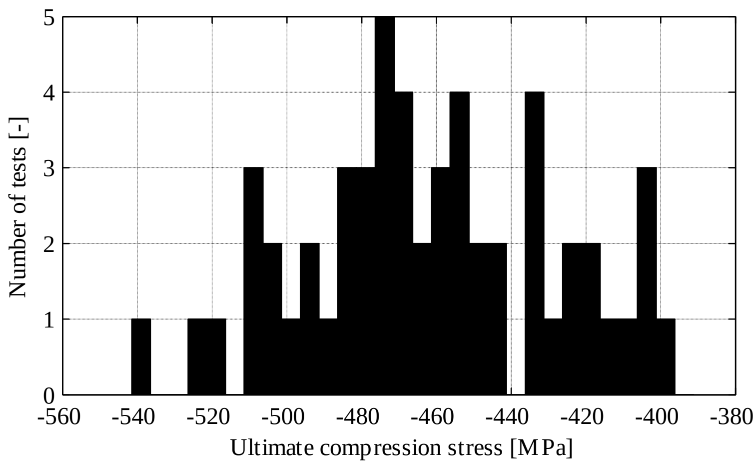

Figure 6: Histogram for static compression strength geometry R04MD2.

The parameters in the SN-curves and their uncertainty are shown in table 4 for the different *R*-ratio's and the corresponding characteristic values are shown in table 5. Plots of the SN-curves fitted to the test results are shown in figure 7-16 and the estimated constant life diagrams are shown in figure 17 and 18. The data sets used are given in appendix 3 and 4.

Table 4: Estimated SN-curves and physical uncertainty for geometry R04MD2 and R03UD2.

Geometry	*R*-ratio	Tests *n*	Run-outs n_0	*m*	log *K*	σ_ε	$\sigma_{\log K}$	$\sigma_{\sigma\varepsilon}$
R03UD2	10.0	46	8	13.860	40.508	0.944	0.151	0.113
R03UD2	-1.0	156	5	9.304	29.644	0.516	0.042	0.030
R03UD2	0.1	57	0	8.405	25.791	0.300	0.039	0.028
R04MD2	2.0	9	3	29.686	73.780	0.354	0.143	0.103
R04MD2	10.0	34	0	22.211	58.664	0.644	0.110	0.078
R04MD2	-2.5	12	2	11.983	35.231	0.633	0.197	0.142
R04MD2	-1.0	87	3	6.719	21.359	0.878	0.095	0.068
R04MD2	-0.4	28	0	7.582	23.398	0.435	0.082	0.058
R04MD2	0.1	47	2	9.508	27.191	0.259	0.039	0.027
R04MD2	0.5	15	0	10.541	27.768	0.358	0.092	0.065

Table 5: Characteristic SN-curves for geometry R04MD2 and R03UD2.

Geometry	*R*-ratio	k_s	$\log K_c$ (with stat. unc.)	k_∞	$\log K_c$ (without stat. unc.)
R03UD2	10.0	2.141	38.487	1.645	38.955
R03UD2	-1.0	1.869	28.680	1.645	28.795
R03UD2	0.1	2.034	25.181	1.645	25.298
R04MD2	2.0	3.720	72.463	1.645	73.198
R04MD2	10.0	2.177	57.262	1.645	57.605
R04MD2	-2.5	2.914	33.386	1.645	34.190
R04MD2	-1.0	1.956	19.641	1.645	19.915
R04MD2	-0.4	2.246	22.421	1.645	22.682
R04MD2	0.1	2.093	26.649	1.645	26.765
R04MD2	0.5	2.567	26.849	1.645	27.179

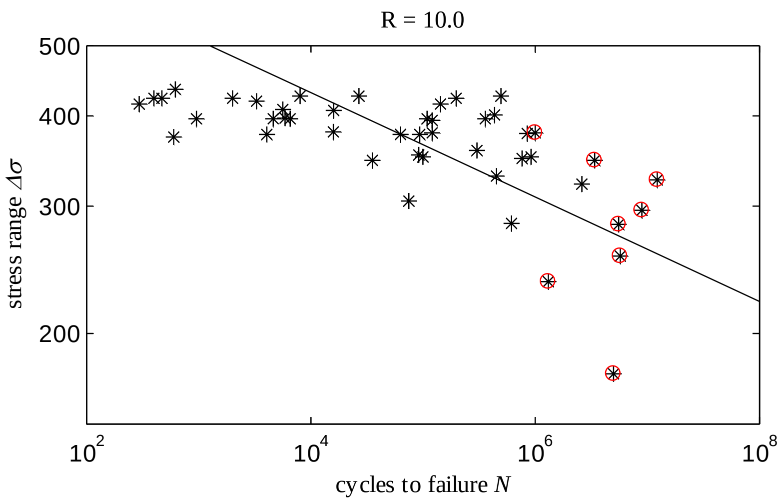

Figure 7: Plot of SN-curve for R=10.0 and geometry R03UD2. Runouts marked with red circles.

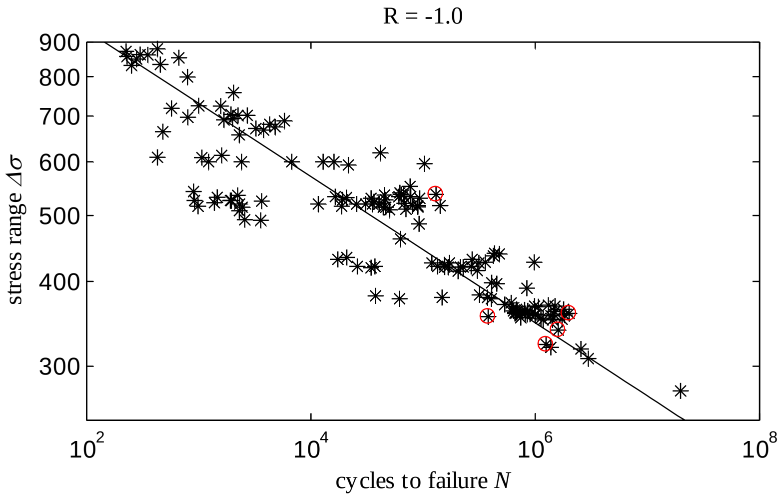

Figure 8: Plot of SN-curve for R=-1.0 and geometry R03UD2. Runouts marked with red circles.

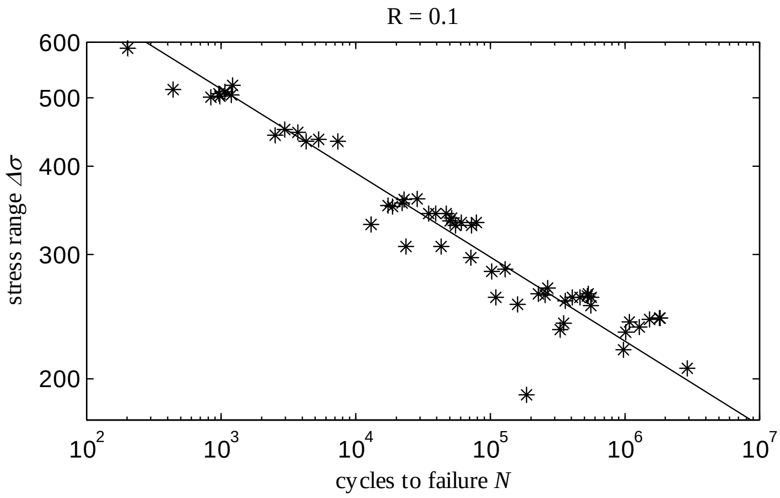

Figure 9: Plot of SN-curve for R=0.1 and geometry R03UD2.

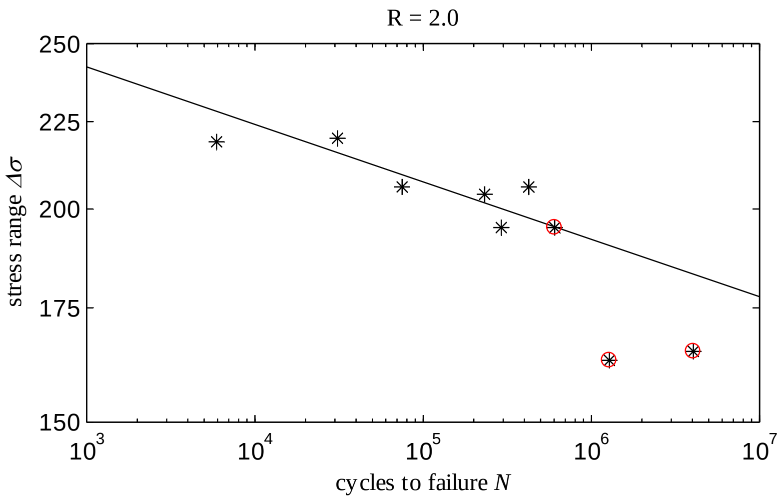

Figure 10: Plot of SN-curve for R=2.0 and geometry R04MD2. Runouts marked with red circles.

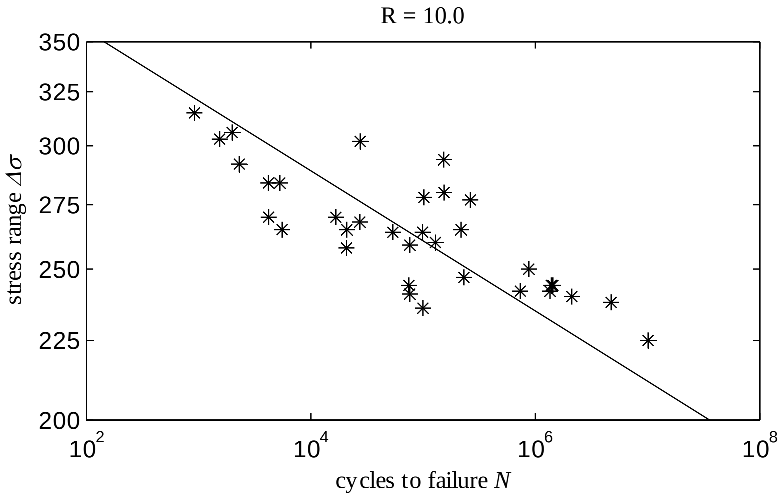

Figure 11: Plot of SN-curve for R=10.0 and geometry R04MD2.

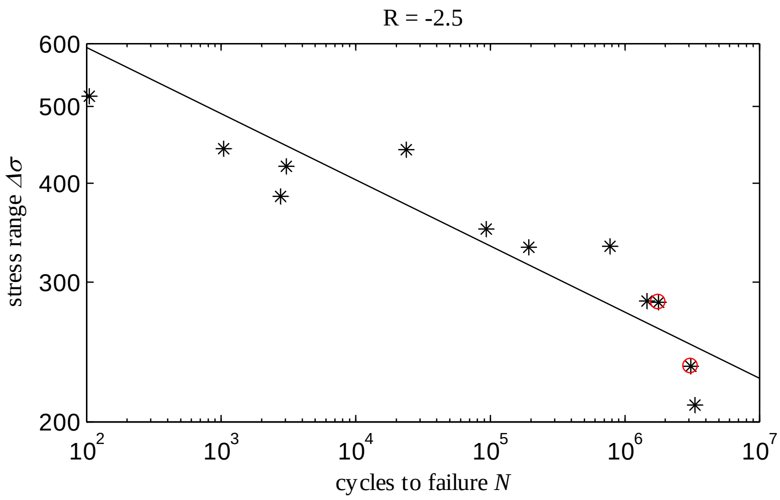

Figure 12: Plot of SN-curve for R=-2.5 and geometry R04MD2. Runouts marked with red circles.

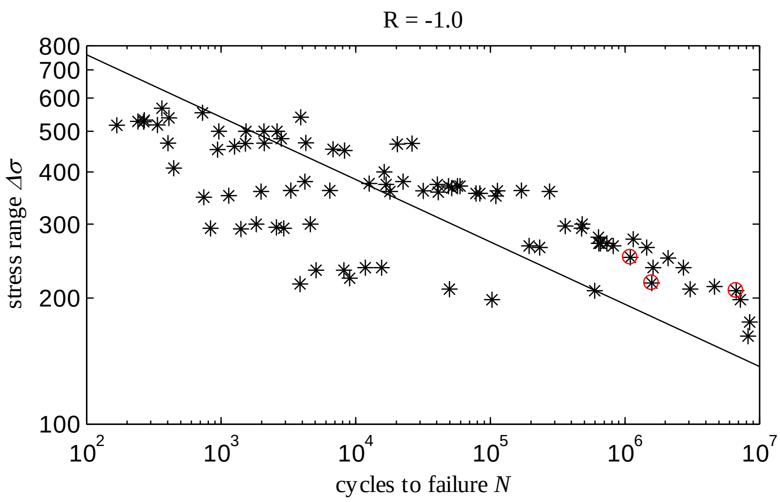

Figure 13: Plot of SN-curve for R=-1.0 and geometry R04MD2. Runouts marked with red circles.

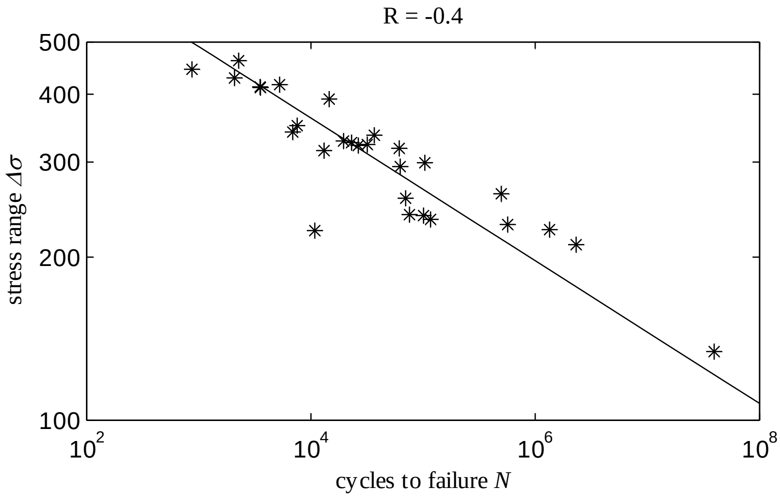

Figure 14: Plot of SN-curve for R=-0.4 and geometry R04MD2.

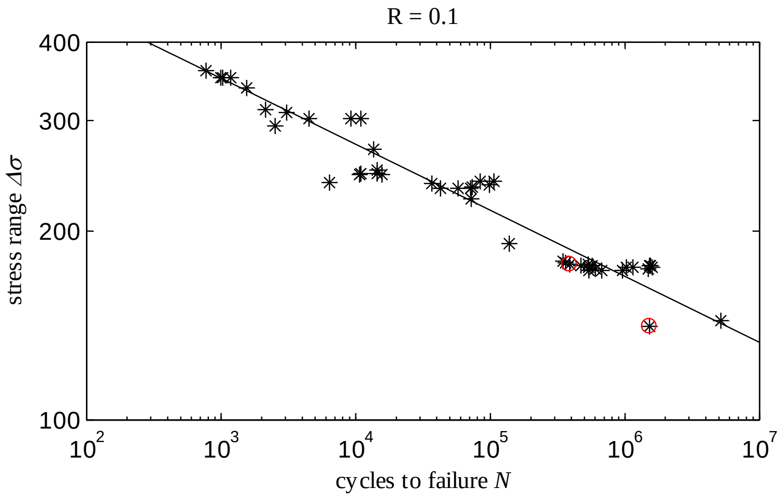

Figure 15: Plot of SN-curve for R=0.1 and geometry R04MD2. Runouts marked with red circles.

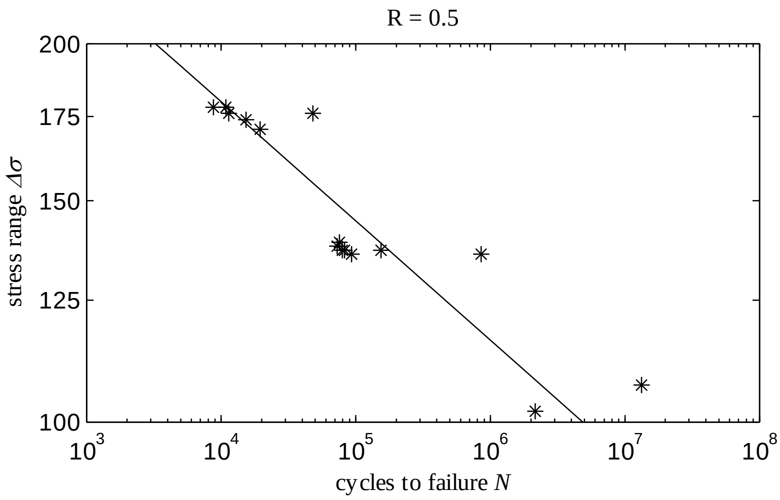

Figure 16: Plot of SN-curve for R=0.5 and geometry R04MD2.

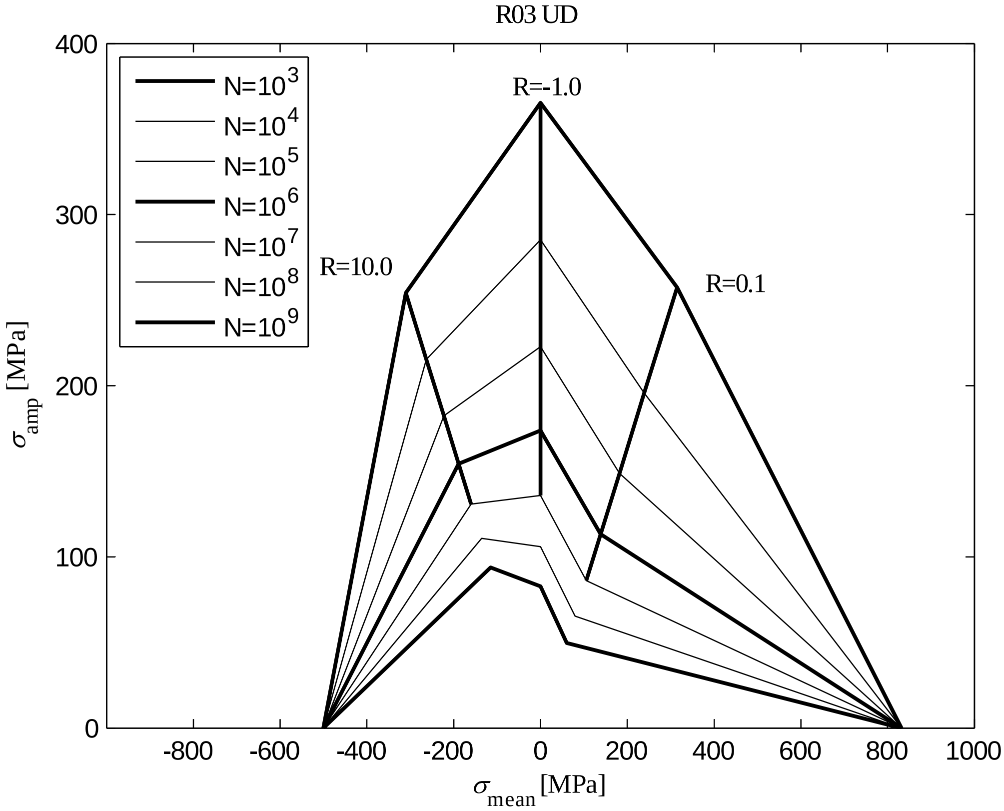

Figure 17: Constant life diagram for geometry R04MD2.

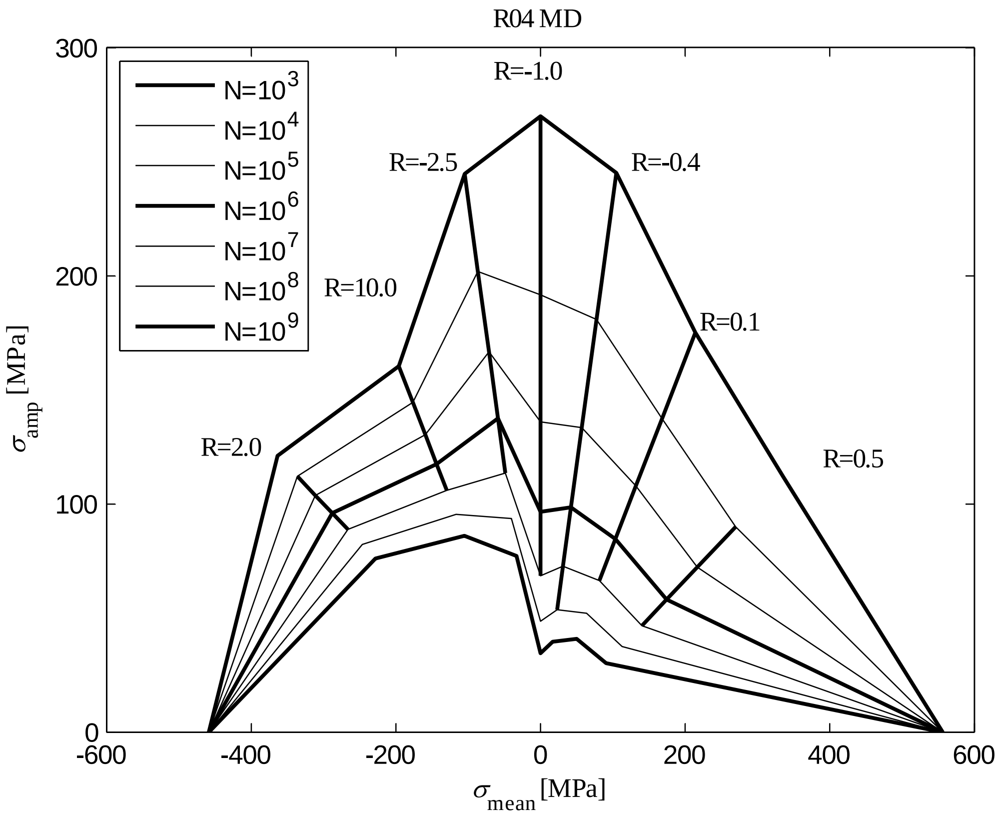

Figure 18: Constant life diagram for geometry R03UD2.

The accumulated damage of failure is estimated for geometry R03UD2 with the Wisper spectrum and for geometry R04MD2 with the Wisper, Wisperx, Reverse Wisper and Reverse Wisperx spectra. The estimated damage at failure is shown in table 4. For geometry R04MD2 and the Wisper spectrum four tests with an accumulated damage significantly above one is observed. Because these four tests differ significantly from the other tests in the Optimat database they are treated as outliers in this report. The variable amplitude fatigue tests are shown in appendix 5 and 6 where the accumulated damage at failure also is estimated for each test.

Table 6: Accumulated damage at failure for geometry R04MD and R03UD.

Geometry	Spectrum	Tests n	Mean μ_Δ	Std. σ_Δ	COV_Δ
R03UD2	Wisper	18	0.35	0.13	0.37
R04MD2	Wisper	10	0.90	0.54	0.60
R04MD2	Wisperx	13	0.28	0.20	0.72
R04MD2	Reverse Wisper	2	0.20	-	-
R04MD2	Reverse Wisperx	10	0.32	0.16	0.50
R04MD2 & R03UD2	All	53	0.43	0.35	0.82
R04MD2 & R03UD2	All values ≤ 1	49	0.34	0.19	0.54

The accumulated damage at failure is modelled by a stochastic variable Δ with mean value μ_Δ which represents the bias on Miners rule and standard deviation σ_Δ which represents the uncertainty on Miners rule (model uncertainty). The accumulated damage is often in probabilistic models modelled by a Lognormal distribution in order to avoid negative values of Miners rule (which are physically impossible). In figure 19 and 20 are shown the estimated accumulated damage at failure for geometry R03UD2 and R04MD2 along with a Lognormal distribution (mean = 0.34 and std. = 0.19).

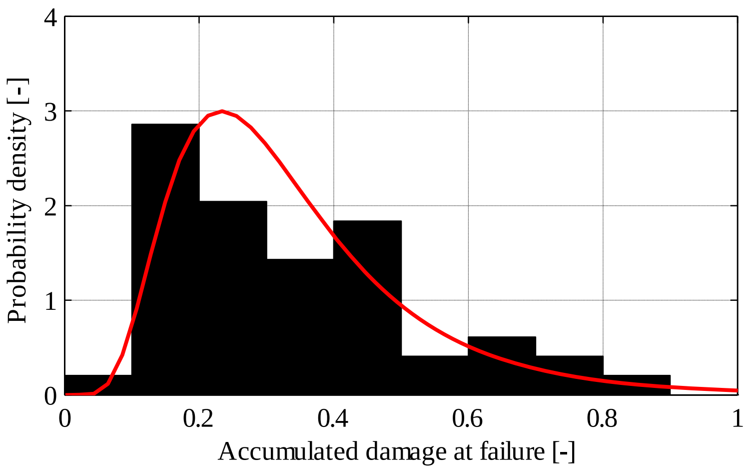

Figure 19: Probability density function for accumulated damage at failure, geometry R03UD2 and R04MD2.

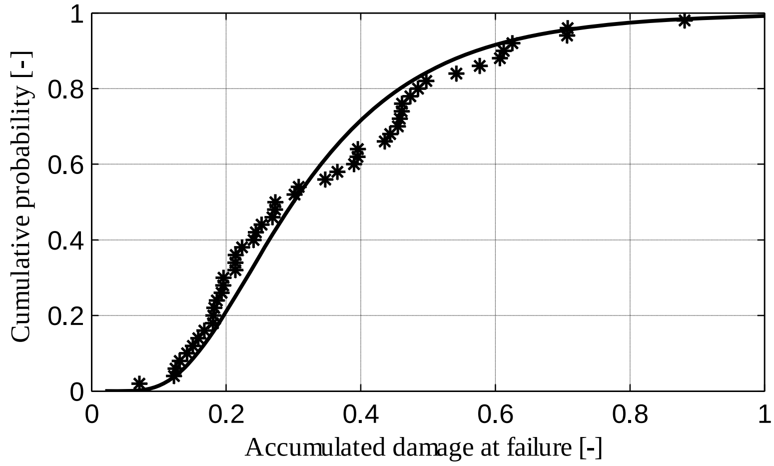

Figure 20: Cumulative density function for accumulated damage at failure, geometry R03UD2 and R04MD2.

Conclusion

In this report static and fatigue tests from the Optimat database have been analyzed in order to determine stochastic models for the physical and model uncertainty related to fatigue design of composite materials.

The physical uncertainty on the ultimate strength is determined from static tests. The results show that the ultimate strength in tension and compression has a coefficient of variation in the range of 7% to 12%.

The physical uncertainty on the fatigue strength is determined from SN-curves which are fitted at different *R*-ratio's based on constant amplitude fatigue tests. The largest physical uncertainties on the SN-curves for geometry R04MD2 are observed for tension-compression fatigue (R = -1 and R = -2.5) whereas the smallest uncertainties are observed for tension-tension fatigue (R = 0.1 and R = 0.5). For geometry R03UD2 the largest uncertainty is observed for compression-compression fatigue (R = 10.0).

The model uncertainty on Miners rule for linear damage accumulation is determined from variable amplitude fatigue tests performed with the Wisper and Wisperx spectra. The accumulated damage at failure is estimated to 0.34 with a standard deviation equal to 0.19. This indicates that Miners rule is both biased and significantly uncertain. The accumulated damage at failure can be modelled by a Lognormal distribution.

Acknowledgement

The work presented in this report is part of the project "Improvement of methods for fatigue assessment" supported by the Danish Energy Authority, EFP2007 grant no. 33033-0077. The financial support is greatly appreciated.

Appendix 1 – Static Tests R03UD2

Table 7: Static tension tests (STT) for geometry R03UD2. In total 103 tests.

No.	Geometry	Type	Optidat No.	Name	σ_{max} [MPa]
1	R03UD2	STT	3732	GEV206_R0300_0312	1016,1
2	R03UD2	STT	3731	GEV206_R0300_0313	961,85
3	R03UD2	STT	3730	GEV206_R0300_0314	952,52
4	R03UD2	STT	3729	GEV206_R0300_0315	961,47
5	R03UD2	STT	3728	GEV206_R0300_0316	994,37
6	R03UD2	STT	2916	GEV206_R0300_0778	919,90
7	R03UD2	STT	2915	GEV206_R0300_0779	933,16
8	R03UD2	STT	2912	GEV206_R0300_0782	843,38
9	R03UD2	STT	2911	GEV206_R0300_0783	920,42
10	R03UD2	STT	2910	GEV206_R0300_0784	940,99
11	R03UD2	STT	2895	GEV206_R0300_0750	920,44
12	R03UD2	STT	2894	GEV206_R0300_0787	883,23
13	R03UD2	STT	2893	GEV206_R0300_0795	897,62
14	R03UD2	STT	2892	GEV206_R0300_0797	935,27
15	R03UD2	STT	2577	GEV206_R0300_0569	1065,26
16	R03UD2	STT	2575	GEV206_R0300_0816	882,94
17	R03UD2	STT	2574	GEV206_R0300_0820	1106,98
18	R03UD2	STT	2573	GEV206_R0300_0825	1049,54
19	R03UD2	STT	2442	GEV206_R0300_0843	1113,51
20	R03UD2	STT	2441	GEV206_R0300_0844	1156,50
21	R03UD2	STT	2440	GEV206_R0300_0847	965,85
22	R03UD2	STT	2413	GEV206_R0300_0554	834,78
23	R03UD2	STT	2412	GEV206_R0300_0823	726,18
24	R03UD2	STT	2411	GEV206_R0300_0829	780,71
25	R03UD2	STT	2410	GEV206_R0300_0842	801,55
26	R03UD2	STT	2409	GEV206_R0300_0850	660,73
27	R03UD2	STT	1222	GEV206_R0300_0282	825,71
28	R03UD2	STT	1221	GEV206_R0300_0281	831,58
29	R03UD2	STT	1220	GEV206_R0300_0280	840,40
30	R03UD2	STT	1219	GEV206_R0300_0278	860,89
31	R03UD2	STT	1218	GEV206_R0300_0277	839,48
32	R03UD2	STT	1217	GEV206_R0300_0276	834,95
33	R03UD2	STT	1195	GEV206_R0300_0081	818,47
34	R03UD2	STT	1194	GEV206_R0300_0077	786,47
35	R03UD2	STT	985	GEV206_R0300_0613	801,95
36	R03UD2	STT	942	GEV206_R0300_0209	765,39
37	R03UD2	STT	941	GEV206_R0300_0208	695,03
38	R03UD2	STT	940	GEV206_R0300_0207	698,83
39	R03UD2	STT	939	GEV206_R0300_0206	825,40
40	R03UD2	STT	938	GEV206_R0300_0205	796,99
41	R03UD2	STT	937	GEV206_R0300_0204	731,37
42	R03UD2	STT	936	GEV206_R0300_0203	836,03
43	R03UD2	STT	935	GEV206_R0300_0202	772,41
44	R03UD2	STT	934	GEV206_R0300_0201	803,13
45	R03UD2	STT	933	GEV206_R0300_0200	752,70
46	R03UD2	STT	932	GEV206_R0300_0199	736,79
47	R03UD2	STT	931	GEV206_R0300_0198	801,81
48	R03UD2	STT	930	GEV206_R0300_0197	765,50
49	R03UD2	STT	929	GEV206_R0300_0196	784,90
50	R03UD2	STT	928	GEV206_R0300_0195	801,78
51	R03UD2	STT	927	GEV206_R0300_0194	800,76
52	R03UD2	STT	926	GEV206_R0300_0193	781,34
53	R03UD2	STT	925	GEV206_R0300_0192	769,16
54	R03UD2	STT	924	GEV206_R0300_0191	787,57

55	R03UD2	STT	923	GEV206_R0300_0190	782,48
56	R03UD2	STT	922	GEV206_R0300_0189	777,33
57	R03UD2	STT	921	GEV206_R0300_0188	793,25
58	R03UD2	STT	920	GEV206_R0300_0187	818,65
59	R03UD2	STT	919	GEV206_R0300_0186	798,23
60	R03UD2	STT	918	GEV206_R0300_0185	774,84
61	R03UD2	STT	917	GEV206_R0300_0184	774,16
62	R03UD2	STT	916	GEV206_R0300_0183	703,94
63	R03UD2	STT	915	GEV206_R0300_0182	764,42
64	R03UD2	STT	914	GEV206_R0300_0181	824,23
65	R03UD2	STT	886	GEV206_R0300_0086	796,19
66	R03UD2	STT	885	GEV206_R0300_0085	802,89
67	R03UD2	STT	884	GEV206_R0300_0084	807,08
68	R03UD2	STT	883	GEV206_R0300_0083	786,02
69	R03UD2	STT	867	GEV204_R0300_0040	826,56
70	R03UD2	STT	866	GEV204_R0300_0035	850,81
71	R03UD2	STT	756	GEV206_R0300_0080	759,87
72	R03UD2	STT	755	GEV206_R0300_0075	798,89
73	R03UD2	STT	754	GEV206_R0300_0073	839,32
74	R03UD2	STT	685	GEV206_R0300_0160	803,27
75	R03UD2	STT	681	GEV206_R0300_0156	811,34
76	R03UD2	STT	680	GEV206_R0300_0154	799,02
77	R03UD2	STT	679	GEV206_R0300_0153	794,02
78	R03UD2	STT	678	GEV206_R0300_0152	867,41
79	R03UD2	STT	676	GEV206_R0300_0150	811,54
80	R03UD2	STT	675	GEV206_R0300_0149	792,76
81	R03UD2	STT	674	GEV206_R0300_0148	812,77
82	R03UD2	STT	664	GEV206_R0300_0138	845,02
83	R03UD2	STT	663	GEV206_R0300_0137	729,31
84	R03UD2	STT	652	GEV206_R0300_0022	787,17
85	R03UD2	STT	648	GEV206_R0300_0016	776,18
86	R03UD2	STT	509	GEV206_R0300_0029	809,60
87	R03UD2	STT	508	GEV206_R0300_0028	814,56
88	R03UD2	STT	507	GEV206_R0300_0027	840,96
89	R03UD2	STT	506	GEV206_R0300_0026	864,66
90	R03UD2	STT	505	GEV206_R0300_0025	862,06
91	R03UD2	STT	475	GEV206_R0300_0065	855,76
92	R03UD2	STT	474	GEV206_R0300_0064	823,58
93	R03UD2	STT	473	GEV206_R0300_0063	834,17
94	R03UD2	STT	472	GEV206_R0300_0062	799,95
95	R03UD2	STT	471	GEV206_R0300_0061	823,85
96	R03UD2	STT	460	GEV206_R0300_0007	776,41
97	R03UD2	STT	450	GEV206_R0300_0057	778,08
98	R03UD2	STT	449	GEV206_R0300_0056	794,18
99	R03UD2	STT	448	GEV206_R0300_0055	777,23
100	R03UD2	STT	444	GEV206_R0300_0051	786,30
101	R03UD2	STT	443	GEV206_R0300_0050	796,24
102	R03UD2	STT	442	GEV206_R0300_0049	795,39
103	R03UD2	STT	292	GEV204_R0300_0046	801,18

Table 8: Static compression tests (STC) for geometry R03UD2. In total 79 tests.

No.	Geometry	Type	Optidat No.	Name	σ_{max} [MPa]
1	R03UD2	STC	2914	GEV206_R0300_0780	-425,33
2	R03UD2	STC	2913	GEV206_R0300_0781	-460,12
3	R03UD2	STC	2418	GEV206_R0300_0358	-393,88
4	R03UD2	STC	2417	GEV206_R0300_0562	-452,02
5	R03UD2	STC	2416	GEV206_R0300_0556	-422,69
6	R03UD2	STC	2415	GEV206_R0300_0830	-325,84
7	R03UD2	STC	2414	GEV206_R0300_0854	-374,35
8	R03UD2	STC	2227	GEV206_R0300_0577	-373,39
9	R03UD2	STC	2226	GEV206_R0300_0553	-438,35
10	R03UD2	STC	2225	GEV206_R0300_0573	-550,30
11	R03UD2	STC	2224	GEV206_R0300_0566	-433,35
12	R03UD2	STC	1211	GEV206_R0300_0269	-546,01
13	R03UD2	STC	1193	GEV206_R0300_0076	-445,97
14	R03UD2	STC	984	GEV206_R0300_0610	-539,69
15	R03UD2	STC	983	GEV206_R0300_0609	-538,04
16	R03UD2	STC	982	GEV206_R0300_0608	-519,40
17	R03UD2	STC	981	GEV206_R0300_0607	-541,58
18	R03UD2	STC	980	GEV206_R0300_0606	-535,40
19	R03UD2	STC	979	GEV206_R0300_0605	-521,30
20	R03UD2	STC	978	GEV206_R0300_0604	-514,38
21	R03UD2	STC	976	GEV206_R0300_0602	-529,46
22	R03UD2	STC	974	GEV206_R0300_0600	-529,59
23	R03UD2	STC	973	GEV206_R0300_0599	-524,60
24	R03UD2	STC	972	GEV206_R0300_0598	-480,82
25	R03UD2	STC	971	GEV206_R0300_0597	-522,98
26	R03UD2	STC	970	GEV206_R0300_0596	-508,38
27	R03UD2	STC	969	GEV206_R0300_0595	-531,65
28	R03UD2	STC	968	GEV206_R0300_0594	-529,16
29	R03UD2	STC	966	GEV206_R0300_0592	-531,15
30	R03UD2	STC	965	GEV206_R0300_0591	-533,04
31	R03UD2	STC	964	GEV206_R0300_0590	-524,56
32	R03UD2	STC	962	GEV206_R0300_0588	-507,89
33	R03UD2	STC	961	GEV206_R0300_0587	-529,53
34	R03UD2	STC	960	GEV206_R0300_0586	-539,97
35	R03UD2	STC	959	GEV206_R0300_0585	-537,14
36	R03UD2	STC	890	GEV206_R0300_0090	-601,17
37	R03UD2	STC	889	GEV206_R0300_0089	-574,24
38	R03UD2	STC	888	GEV206_R0300_0088	-547,63
39	R03UD2	STC	887	GEV206_R0300_0087	-586,40
40	R03UD2	STC	869	GEV204_R0300_0050	-496,07
41	R03UD2	STC	868	GEV204_R0300_0045	-532,39
42	R03UD2	STC	753	GEV206_R0300_0082	-553,82
43	R03UD2	STC	752	GEV206_R0300_0079	-587,26
44	R03UD2	STC	751	GEV206_R0300_0074	-505,21
45	R03UD2	STC	684	GEV206_R0300_0159	-454,50
46	R03UD2	STC	682	GEV206_R0300_0157	-450,76
47	R03UD2	STC	672	GEV206_R0300_0146	-443,86
48	R03UD2	STC	671	GEV206_R0300_0145	-435,06
49	R03UD2	STC	667	GEV206_R0300_0141	-443,29
50	R03UD2	STC	666	GEV206_R0300_0140	-445,08
51	R03UD2	STC	658	GEV206_R0300_0132	-456,75
52	R03UD2	STC	657	GEV206_R0300_0131	-465,34
53	R03UD2	STC	656	GEV206_R0300_0130	-457,32
54	R03UD2	STC	655	GEV206_R0300_0129	-474,04
55	R03UD2	STC	514	GEV206_R0300_0034	-569,50
56	R03UD2	STC	513	GEV206_R0300_0033	-627,63
57	R03UD2	STC	512	GEV206_R0300_0032	-591,05
58	R03UD2	STC	511	GEV206_R0300_0031	-553,49

59	R03UD2	STC	510	GEV206_R0300_0030	-599,65
60	R03UD2	STC	480	GEV206_R0300_0070	-553,77
61	R03UD2	STC	479	GEV206_R0300_0069	-555,14
62	R03UD2	STC	478	GEV206_R0300_0068	-567,05
63	R03UD2	STC	477	GEV206_R0300_0067	-565,95
64	R03UD2	STC	476	GEV206_R0300_0066	-561,50
65	R03UD2	STC	459	GEV206_R0300_0006	-493,86
66	R03UD2	STC	458	GEV206_R0300_0005	-478,89
67	R03UD2	STC	457	GEV206_R0300_0004	-488,33
68	R03UD2	STC	456	GEV206_R0300_0003	-480,62
69	R03UD2	STC	455	GEV206_R0300_0002	-489,61
70	R03UD2	STC	454	GEV206_R0300_0001	-504,44
71	R03UD2	STC	453	GEV206_R0300_0060	-486,89
72	R03UD2	STC	452	GEV206_R0300_0059	-491,99
73	R03UD2	STC	451	GEV206_R0300_0058	-473,09
74	R03UD2	STC	447	GEV206_R0300_0054	-472,63
75	R03UD2	STC	446	GEV206_R0300_0053	-397,56
76	R03UD2	STC	445	GEV206_R0300_0052	-393,42
77	R03UD2	STC	287	GEV204_R0300_0041	-484,12
78	R03UD2	STC	282	GEV204_R0300_0036	-440,17
79	R03UD2	STC	278	GEV204_R0300_0032	-451,04

Appendix 2 – Static Tests R04MD2

Table 9: Static tension tests (STT) for geometry R04MD2. In total 66 tests.

No.	Geometry	Type	Optidat No.	Name	σ_{max} [MPa]
1	R04MD2	STT	3712	GEV207_R0400_0187	632,81
2	R04MD2	STT	3711	GEV207_R0400_0189	649,14
3	R04MD2	STT	3710	GEV207_R0400_0190	674,07
4	R04MD2	STT	3709	GEV207_R0400_0191	660,82
5	R04MD2	STT	3708	GEV207_R0400_0198	649,95
6	R04MD2	STT	2891	GEV207_R0400_0649	498,85
7	R04MD2	STT	2890	GEV207_R0400_0664	595,73
8	R04MD2	STT	2889	GEV207_R0400_0687	598,78
9	R04MD2	STT	2797	GEV207_R0400_1053	630,26
10	R04MD2	STT	2784	GEV207_R0400_1077	574,99
11	R04MD2	STT	2443	GEV207_R0400_0266	664,60
12	R04MD2	STT	2439	GEV207_R0400_0759	526,74
13	R04MD2	STT	2438	GEV207_R0400_0761	723,27
14	R04MD2	STT	2437	GEV207_R0400_0762	713,84
15	R04MD2	STT	2436	GEV207_R0400_0766	731,92
16	R04MD2	STT	2435	GEV207_R0400_0772	724,17
17	R04MD2	STT	2434	GEV207_R0400_0812	645,22
18	R04MD2	STT	2373	GEV207_R0400_0193	538,28
19	R04MD2	STT	2372	GEV207_R0400_0194	534,34
20	R04MD2	STT	2371	GEV207_R0400_0195	538,42
21	R04MD2	STT	2370	GEV207_R0400_0196	542,46
22	R04MD2	STT	2369	GEV207_R0400_0197	535,40
23	R04MD2	STT	2280	GEV207_R0400_0376	512,53
24	R04MD2	STT	2141	GEV207_R0400_0255	485,33
25	R04MD2	STT	2140	GEV207_R0400_0510	462,24
26	R04MD2	STT	2139	GEV207_R0400_0235	495,89
27	R04MD2	STT	2138	GEV207_R0400_0230	466,95
28	R04MD2	STT	2137	GEV207_R0400_0595	574,70
29	R04MD2	STT	1200	GEV207_R0400_0086	522,00
30	R04MD2	STT	1199	GEV207_R0400_0085	504,58
31	R04MD2	STT	1198	GEV207_R0400_0084	514,53
32	R04MD2	STT	1197	GEV207_R0400_0083	508,17
33	R04MD2	STT	1196	GEV207_R0400_0082	504,37
34	R04MD2	STT	990	GEV207_R0400_0242	513,61
35	R04MD2	STT	989	GEV207_R0400_0241	520,81
36	R04MD2	STT	988	GEV207_R0400_0240	520,32
37	R04MD2	STT	987	GEV207_R0400_0238	511,17
38	R04MD2	STT	986	GEV207_R0400_0237	525,91
39	R04MD2	STT	877	GEV205_R0400_0069	517,42
40	R04MD2	STT	876	GEV205_R0400_0068	577,60
41	R04MD2	STT	730	GEV207_R0400_0261	549,35
42	R04MD2	STT	728	GEV207_R0400_0259	534,53
43	R04MD2	STT	723	GEV207_R0400_0234	547,35
44	R04MD2	STT	708	GEV207_R0400_0022	536,51
45	R04MD2	STT	707	GEV207_R0400_0021	550,23
46	R04MD2	STT	706	GEV207_R0400_0020	522,55
47	R04MD2	STT	704	GEV207_R0400_0018	522,92
48	R04MD2	STT	701	GEV207_R0400_0015	522,29
49	R04MD2	STT	695	GEV207_R0400_0009	517,65
50	R04MD2	STT	694	GEV207_R0400_0008	509,27
51	R04MD2	STT	690	GEV207_R0400_0004	497,51
52	R04MD2	STT	529	GEV207_R0400_0145	547,70
53	R04MD2	STT	528	GEV207_R0400_0144	551,46
54	R04MD2	STT	527	GEV207_R0400_0143	574,52

55	R04MD2	STT	526	GEV207_R0400_0142	578,02
56	R04MD2	STT	525	GEV207_R0400_0141	543,94
57	R04MD2	STT	519	GEV207_R0400_0138	525,90
58	R04MD2	STT	518	GEV207_R0400_0137	536,28
59	R04MD2	STT	517	GEV207_R0400_0136	539,21
60	R04MD2	STT	516	GEV207_R0400_0135	535,24
61	R04MD2	STT	515	GEV207_R0400_0134	528,81
62	R04MD2	STT	499	GEV207_R0400_0078	530,83
63	R04MD2	STT	498	GEV207_R0400_0077	500,55
64	R04MD2	STT	497	GEV207_R0400_0076	525,84
65	R04MD2	STT	496	GEV207_R0400_0075	519,52
66	R04MD2	STT	495	GEV207_R0400_0074	517,88

Table 10: Static compression tests (STC) for geometry R04MD2. In total 55 tests.

No.	Geometry	Type	Optidat No.	Name	σ_{max} [MPa]
1	R04MD2	STC	3232	GEV207_R0400_0377	-423,01
2	R04MD2	STC	3218	GEV207_R0400_0504	-416,08
3	R04MD2	STC	3217	GEV207_R0400_0508	-430,74
4	R04MD2	STC	3216	GEV207_R0400_0228	-466,77
5	R04MD2	STC	3215	GEV207_R0400_0260	-451,40
6	R04MD2	STC	2802	GEV207_R0400_1041	-507,28
7	R04MD2	STC	2793	GEV207_R0400_1061	-427,13
8	R04MD2	STC	2788	GEV207_R0400_1069	-476,36
9	R04MD2	STC	2136	GEV207_R0400_0492	-421,64
10	R04MD2	STC	2135	GEV207_R0400_0600	-432,13
11	R04MD2	STC	1205	GEV207_R0400_0091	-491,53
12	R04MD2	STC	1204	GEV207_R0400_0090	-472,17
13	R04MD2	STC	1203	GEV207_R0400_0089	-450,42
14	R04MD2	STC	1202	GEV207_R0400_0088	-429,29
15	R04MD2	STC	1201	GEV207_R0400_0087	-402,76
16	R04MD2	STC	996	GEV207_R0400_0248	-442,34
17	R04MD2	STC	995	GEV207_R0400_0247	-443,79
18	R04MD2	STC	994	GEV207_R0400_0246	-431,20
19	R04MD2	STC	993	GEV207_R0400_0245	-452,75
20	R04MD2	STC	992	GEV207_R0400_0244	-446,55
21	R04MD2	STC	991	GEV207_R0400_0243	-445,67
22	R04MD2	STC	749	GEV207_R0400_0280	-393,70
23	R04MD2	STC	747	GEV207_R0400_0278	-484,02
24	R04MD2	STC	745	GEV207_R0400_0276	-463,64
25	R04MD2	STC	744	GEV207_R0400_0275	-472,22
26	R04MD2	STC	739	GEV207_R0400_0270	-465,01
27	R04MD2	STC	736	GEV207_R0400_0267	-480,96
28	R04MD2	STC	733	GEV207_R0400_0264	-473,54
29	R04MD2	STC	725	GEV207_R0400_0256	-469,50
30	R04MD2	STC	715	GEV207_R0400_0226	-470,29
31	R04MD2	STC	712	GEV207_R0400_0223	-458,05
32	R04MD2	STC	710	GEV207_R0400_0024	-458,47
33	R04MD2	STC	703	GEV207_R0400_0017	-483,56
34	R04MD2	STC	700	GEV207_R0400_0014	-452,77
35	R04MD2	STC	698	GEV207_R0400_0012	-467,82
36	R04MD2	STC	697	GEV207_R0400_0011	-459,12
37	R04MD2	STC	696	GEV207_R0400_0010	-492,62
38	R04MD2	STC	693	GEV207_R0400_0007	-465,09
39	R04MD2	STC	688	GEV207_R0400_0002	-480,04
40	R04MD2	STC	534	GEV207_R0400_0150	-538,98
41	R04MD2	STC	533	GEV207_R0400_0149	-517,08
42	R04MD2	STC	532	GEV207_R0400_0148	-474,03
43	R04MD2	STC	531	GEV207_R0400_0147	-504,33
44	R04MD2	STC	530	GEV207_R0400_0146	-508,39
45	R04MD2	STC	524	GEV207_R0400_0102	-474,45
46	R04MD2	STC	523	GEV207_R0400_0101	-501,04
47	R04MD2	STC	522	GEV207_R0400_0100	-500,25
48	R04MD2	STC	521	GEV207_R0400_0099	-498,68
49	R04MD2	STC	520	GEV207_R0400_0098	-457,07
50	R04MD2	STC	504	GEV207_R0400_0033	-416,13
51	R04MD2	STC	503	GEV207_R0400_0030	-403,55
52	R04MD2	STC	502	GEV207_R0400_0029	-402,26
53	R04MD2	STC	501	GEV207_R0400_0027	-404,63
54	R04MD2	STC	500	GEV207_R0400_0034	-409,86
55	R04MD2	STC	373	GEV205_R0400_0037	-522,92

Appendix 3 – Constant Amplitude Fatigue Tests R03UD2

Table 11: Constant amplitude fatigue tests with R=10.0 for geometry R03UD2. In total 46 tests from which 8 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R03UD2	10.0	3527	GEV206_R0300_0903	-385,7	3395420	x
2	R03UD2	10.0	3204	GEV206_R0300_0353	-473,12	26772	
3	R03UD2	10.0	3202	GEV206_R0300_0564	-473,12	8000	
4	R03UD2	10.0	3055	GEV206_R0300_0883	-358,21	2602762	
5	R03UD2	10.0	2849	GEV206_R0300_0558	-437,54	120225	
6	R03UD2	10.0	2848	GEV206_R0300_0851	-483,23	617	
7	R03UD2	10.0	2844	GEV206_R0300_0864	-445,87	434230	
8	R03UD2	10.0	2843	GEV206_R0300_0876	-390,13	99431	
9	R03UD2	10.0	2775	GEV206_R0300_0871	-361,98	12259187	x
10	R03UD2	10.0	2763	GEV206_R0300_0905	-328,41	8951810	x
11	R03UD2	10.0	2718	GEV206_R0300_0427	-440,27	4605	
12	R03UD2	10.0	2715	GEV206_R0300_0454	-440,28	108808	
13	R03UD2	10.0	2714	GEV206_R0300_0611	-421,91	15820	
14	R03UD2	10.0	2713	GEV206_R0300_0612	-419,05	93273	
15	R03UD2	10.0	2712	GEV206_R0300_0614	-440,34	358110	
16	R03UD2	10.0	2711	GEV206_R0300_0616	-419,07	4035	
17	R03UD2	10.0	2710	GEV206_R0300_0617	-440,35	6517	
18	R03UD2	10.0	2708	GEV206_R0300_0622	-440,34	952	
19	R03UD2	10.0	2706	GEV206_R0300_0626	-418,99	62784	
20	R03UD2	10.0	2617	GEV206_R0300_0347	-460,96	143229	
21	R03UD2	10.0	2600	GEV206_R0300_0879	-389,52	917908	
22	R03UD2	10.0	2599	GEV206_R0300_0885	-473,08	493412	
23	R03UD2	10.0	2598	GEV206_R0300_0910	-387,88	764708	
24	R03UD2	10.0	2597	GEV206_R0300_0930	-392,40	91658	
25	R03UD2	10.0	1956	GEV206_R0300_0688	-195,00	5000000	x
26	R03UD2	10.0	1954	GEV206_R0300_0690	-284,92	5721979	x
27	R03UD2	10.0	1953	GEV206_R0300_0691	-314,24	5554544	x
28	R03UD2	10.0	1952	GEV206_R0300_0692	-339,44	74629	
29	R03UD2	10.0	1951	GEV206_R0300_0740	-385,70	35325	
30	R03UD2	10.0	1950	GEV206_R0300_0741	-415,79	598	
31	R03UD2	10.0	1155	GEV206_R0300_0287	-262,33	1310500	x
32	R03UD2	10.0	1153	GEV206_R0300_0296	-366,48	451169	
33	R03UD2	10.0	1152	GEV206_R0300_0295	-315,57	613515	
34	R03UD2	10.0	1100	GEV206_R0300_0421	-466,07	3284	
35	R03UD2	10.0	1099	GEV206_R0300_0420	-470,46	398	
36	R03UD2	10.0	1098	GEV206_R0300_0214	-470,44	469	
37	R03UD2	10.0	1095	GEV206_R0300_0451	-419,63	845622	
38	R03UD2	10.0	1094	GEV206_R0300_0449	-452,77	15990	
39	R03UD2	10.0	1093	GEV206_R0300_0439	-452,80	5616	
40	R03UD2	10.0	1092	GEV206_R0300_0423	-470,47	2008	
41	R03UD2	10.0	1091	GEV206_R0300_0422	-469,48	197825	
42	R03UD2	10.0	896	GEV206_R0300_0096	-440,78	5869	
43	R03UD2	10.0	895	GEV206_R0300_0095	-421,40	120285	
44	R03UD2	10.0	894	GEV206_R0300_0094	-461,01	295	
45	R03UD2	10.0	893	GEV206_R0300_0093	-397,90	301530	
46	R03UD2	10.0	892	GEV206_R0300_0092	-421,56	1000000	x

Table 12: Constant amplitude fatigue tests with R=-1.0 for geometry R03UD2. In total 156 tests from which 5 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R03UD2	-1.0	3747	GEV206_R0300_0335	258,65	89458	
2	R03UD2	-1.0	3746	GEV206_R0300_0336	258,69	80441	
3	R03UD2	-1.0	3745	GEV206_R0300_0337	258,69	141641	
4	R03UD2	-1.0	3744	GEV206_R0300_0338	213,33	359001	
5	R03UD2	-1.0	3743	GEV206_R0300_0339	213,33	982252	
6	R03UD2	-1.0	2842	GEV206_R0300_0918	186,18	609465	
7	R03UD2	-1.0	2620	GEV206_R0300_0372	306,63	1603	
8	R03UD2	-1.0	2619	GEV206_R0300_0538	257,46	89483	
9	R03UD2	-1.0	2618	GEV206_R0300_0526	424,32	280	
10	R03UD2	-1.0	2279	GEV206_R0300_0259	137,84	19854604	
11	R03UD2	-1.0	2254	GEV206_R0300_0378	178,47	999129	
12	R03UD2	-1.0	2253	GEV206_R0300_0370	179,15	847417	
13	R03UD2	-1.0	2251	GEV206_R0300_0532	260,50	68131	
14	R03UD2	-1.0	2250	GEV206_R0300_0375	426,73	666	
15	R03UD2	-1.0	2249	GEV206_R0300_0552	428,48	229	
16	R03UD2	-1.0	2248	GEV206_R0300_0368	263,73	19151	
17	R03UD2	-1.0	2247	GEV206_R0300_0373	429,53	32	
18	R03UD2	-1.0	2246	GEV206_R0300_0521	431,07	300	
19	R03UD2	-1.0	2245	GEV206_R0300_0364	266,62	77850	
20	R03UD2	-1.0	2244	GEV206_R0300_0371	184,05	983965	
21	R03UD2	-1.0	2243	GEV206_R0300_0551	436,10	225	
22	R03UD2	-1.0	2218	GEV206_R0300_0369	176,27	1121521	
23	R03UD2	-1.0	2217	GEV206_R0300_0531	255,26	70434	
24	R03UD2	-1.0	2216	GEV206_R0300_0523	417,21	453	
25	R03UD2	-1.0	2215	GEV206_R0300_0382	256,75	46630	
26	R03UD2	-1.0	2214	GEV206_R0300_0533	178,04	1382433	
27	R03UD2	-1.0	2213	GEV206_R0300_0367	257,92	18829	
28	R03UD2	-1.0	2026	GEV206_R0300_0323	210,11	227500	
29	R03UD2	-1.0	2025	GEV206_R0300_0324	159,97	1375999	
30	R03UD2	-1.0	2024	GEV206_R0300_0328	265,07	34349	
31	R03UD2	-1.0	2023	GEV206_R0300_0330	181,37	804000	
32	R03UD2	-1.0	2022	GEV206_R0300_0331	181,21	690000	
33	R03UD2	-1.0	2021	GEV206_R0300_0332	181,10	860500	
34	R03UD2	-1.0	2020	GEV206_R0300_0333	212,99	119500	
35	R03UD2	-1.0	2019	GEV206_R0300_0334	210,17	156000	
36	R03UD2	-1.0	1666	GEV206_R0300_0250	415,56	252	
37	R03UD2	-1.0	1665	GEV206_R0300_0251	430,31	352	
38	R03UD2	-1.0	1664	GEV206_R0300_0252	439,26	428	
39	R03UD2	-1.0	1663	GEV206_R0300_0253	266,43	60877	
40	R03UD2	-1.0	1662	GEV206_R0300_0254	267,87	66715	
41	R03UD2	-1.0	1661	GEV206_R0300_0255	262,52	3653	
42	R03UD2	-1.0	1660	GEV206_R0300_0256	180,73	1488745	
43	R03UD2	-1.0	1659	GEV206_R0300_0257	178,42	1829136	
44	R03UD2	-1.0	1658	GEV206_R0300_0258	181,88	1795752	
45	R03UD2	-1.0	1369	GEV206_R0300_0625	175,53	1177955	
46	R03UD2	-1.0	1330	GEV206_R0300_0442	175,97	1734291	
47	R03UD2	-1.0	1329	GEV206_R0300_0627	337,43	4810	
48	R03UD2	-1.0	1328	GEV206_R0300_0162	333,91	3797	
49	R03UD2	-1.0	1327	GEV206_R0300_0628	344,64	5787	
50	R03UD2	-1.0	1326	GEV206_R0300_0497	335,68	3228	
51	R03UD2	-1.0	1325	GEV206_R0300_0452	340,37	4300	
52	R03UD2	-1.0	1316	GEV206_R0300_0426	264,79	93347	
53	R03UD2	-1.0	1315	GEV206_R0300_0425	179,52	2000011	x
54	R03UD2	-1.0	1216	GEV206_R0300_0274	275,96	76709	
55	R03UD2	-1.0	1215	GEV206_R0300_0273	270,04	62149	
56	R03UD2	-1.0	1214	GEV206_R0300_0272	184,35	1307035	
57	R03UD2	-1.0	1213	GEV206_R0300_0271	218,22	422882	

58	R03UD2	-1.0	1212	GEV206_R0300_0270	183,65	1063405	
59	R03UD2	-1.0	1210	GEV206_R0300_0268	309,15	41581	
60	R03UD2	-1.0	1209	GEV206_R0300_0267	219,47	479546	
61	R03UD2	-1.0	1208	GEV206_R0300_0266	183,89	1502047	
62	R03UD2	-1.0	1207	GEV206_R0300_0265	220,15	433521	
63	R03UD2	-1.0	1206	GEV206_R0300_0078	268,26	63605	
64	R03UD2	-1.0	1191	GEV206_R0300_0352	347,23	2005	
65	R03UD2	-1.0	1190	GEV206_R0300_0351	345,73	1673	
66	R03UD2	-1.0	1189	GEV206_R0300_0350	350,92	2237	
67	R03UD2	-1.0	1188	GEV206_R0300_0349	352,17	1941	
68	R03UD2	-1.0	1187	GEV206_R0300_0348	268,72	130393	x
69	R03UD2	-1.0	1166	GEV206_R0300_0123	259,95	30712	
70	R03UD2	-1.0	1165	GEV206_R0300_0122	210,05	167968	
71	R03UD2	-1.0	1164	GEV206_R0300_0121	210,02	214983	
72	R03UD2	-1.0	1163	GEV206_R0300_0120	260,01	40605	
73	R03UD2	-1.0	1162	GEV206_R0300_0119	210,27	135051	
74	R03UD2	-1.0	1161	GEV206_R0300_0118	260,04	25565	
75	R03UD2	-1.0	1160	GEV206_R0300_0117	299,97	6753	
76	R03UD2	-1.0	1159	GEV206_R0300_0116	180,02	658702	
77	R03UD2	-1.0	1158	GEV206_R0300_0115	180,01	675361	
78	R03UD2	-1.0	1157	GEV206_R0300_0114	179,97	682835	
79	R03UD2	-1.0	1156	GEV206_R0300_0218	216,97	20937	
80	R03UD2	-1.0	1144	GEV206_R0300_0309	179,15	1457815	
81	R03UD2	-1.0	1089	GEV206_R0300_0310	178,83	998797	
82	R03UD2	-1.0	1088	GEV206_R0300_0493	207,48	304399	
83	R03UD2	-1.0	1087	GEV206_R0300_0492	265,27	20760	
84	R03UD2	-1.0	1086	GEV206_R0300_0490	260,21	35286	
85	R03UD2	-1.0	1085	GEV206_R0300_0489	362,39	1001	
86	R03UD2	-1.0	1084	GEV206_R0300_0488	359,29	570	
87	R03UD2	-1.0	1083	GEV206_R0300_0487	362,18	1575	
88	R03UD2	-1.0	1082	GEV206_R0300_0486	255,18	50281	
89	R03UD2	-1.0	1081	GEV206_R0300_0484	300,00	16105	
90	R03UD2	-1.0	1080	GEV206_R0300_0482	300,00	2405	
91	R03UD2	-1.0	1079	GEV206_R0300_0481	300,00	1225	
92	R03UD2	-1.0	1078	GEV206_R0300_0480	300,00	12809	
93	R03UD2	-1.0	1075	GEV206_R0300_0224	191,24	317800	
94	R03UD2	-1.0	1074	GEV206_R0300_0219	189,62	375765	
95	R03UD2	-1.0	955	GEV206_R0300_0444	175,38	1420061	
96	R03UD2	-1.0	947	GEV206_R0300_0419	169,42	1598170	x
97	R03UD2	-1.0	946	GEV206_R0300_0213	177,31	380132	x
98	R03UD2	-1.0	944	GEV206_R0300_0211	261,78	36603	
99	R03UD2	-1.0	943	GEV206_R0300_0210	179,75	812946	
100	R03UD2	-1.0	912	GEV206_R0300_0179	257,09	44079	
101	R03UD2	-1.0	911	GEV206_R0300_0178	179,74	661598	
102	R03UD2	-1.0	910	GEV206_R0300_0177	161,31	1250000	x
103	R03UD2	-1.0	909	GEV206_R0300_0176	184,93	535132	
104	R03UD2	-1.0	908	GEV206_R0300_0175	211,51	154582	
105	R03UD2	-1.0	907	GEV206_R0300_0174	263,38	46263	
106	R03UD2	-1.0	906	GEV206_R0300_0173	206,84	204841	
107	R03UD2	-1.0	905	GEV206_R0300_0172	210,70	268157	
108	R03UD2	-1.0	904	GEV206_R0300_0171	215,51	274849	
109	R03UD2	-1.0	903	GEV206_R0300_0170	180,37	685783	
110	R03UD2	-1.0	902	GEV206_R0300_0169	212,87	314452	
111	R03UD2	-1.0	901	GEV206_R0300_0168	188,48	407204	
112	R03UD2	-1.0	900	GEV206_R0300_0167	267,89	45377	
113	R03UD2	-1.0	899	GEV206_R0300_0165	178,87	897619	
114	R03UD2	-1.0	898	GEV206_R0300_0164	266,35	16436	
115	R03UD2	-1.0	897	GEV206_R0300_0163	267,42	2230	
116	R03UD2	-1.0	686	GEV206_R0300_0161	159,17	2551489	
117	R03UD2	-1.0	683	GEV206_R0300_0158	177,19	741879	

118	R03UD2	-1.0	677	GEV206_R0300_0151	296,51	21637	
119	R03UD2	-1.0	673	GEV206_R0300_0147	198,70	454761	
120	R03UD2	-1.0	670	GEV206_R0300_0144	328,26	2305	
121	R03UD2	-1.0	669	GEV206_R0300_0143	246,09	3576	
122	R03UD2	-1.0	668	GEV206_R0300_0142	351,01	2702	
123	R03UD2	-1.0	665	GEV206_R0300_0139	181,98	681605	
124	R03UD2	-1.0	662	GEV206_R0300_0136	253,77	2306	
125	R03UD2	-1.0	661	GEV206_R0300_0135	256,89	2440	
126	R03UD2	-1.0	660	GEV206_R0300_0134	181,24	637624	
127	R03UD2	-1.0	659	GEV206_R0300_0133	304,52	427	
128	R03UD2	-1.0	654	GEV206_R0300_0024	189,47	147344	
129	R03UD2	-1.0	653	GEV206_R0300_0023	263,16	918	
130	R03UD2	-1.0	651	GEV206_R0300_0021	209,69	34434	
131	R03UD2	-1.0	650	GEV206_R0300_0020	210,53	25909	
132	R03UD2	-1.0	649	GEV206_R0300_0019	188,72	61583	
133	R03UD2	-1.0	647	GEV206_R0300_0015	263,16	1915	
134	R03UD2	-1.0	562	GEV206_R0300_0240	332,17	480	
135	R03UD2	-1.0	561	GEV206_R0300_0239	348,46	801	
136	R03UD2	-1.0	560	GEV206_R0300_0238	303,78	1067	
137	R03UD2	-1.0	559	GEV206_R0300_0237	399,54	795	
138	R03UD2	-1.0	558	GEV206_R0300_0236	243,03	92160	
139	R03UD2	-1.0	557	GEV206_R0300_0235	270,85	898	
140	R03UD2	-1.0	556	GEV206_R0300_0234	297,98	102733	
141	R03UD2	-1.0	555	GEV206_R0300_0233	199,25	409950	
142	R03UD2	-1.0	554	GEV206_R0300_0232	195,44	844145	
143	R03UD2	-1.0	553	GEV206_R0300_0231	378,99	2050	
144	R03UD2	-1.0	552	GEV206_R0300_0230	246,36	2566	
145	R03UD2	-1.0	551	GEV206_R0300_0229	213,06	172044	
146	R03UD2	-1.0	549	GEV206_R0300_0225	265,83	1458	
147	R03UD2	-1.0	548	GEV206_R0300_0217	258,10	985	
148	R03UD2	-1.0	547	GEV206_R0300_0216	215,28	17370	
149	R03UD2	-1.0	468	GEV206_R0300_0017	210,53	37153	
150	R03UD2	-1.0	463	GEV206_R0300_0010	190,29	37601	
151	R03UD2	-1.0	462	GEV206_R0300_0009	153,85	2972910	
152	R03UD2	-1.0	461	GEV206_R0300_0008	263,16	1952	
153	R03UD2	-1.0	293	GEV204_R0300_0047	260,00	11627	
154	R03UD2	-1.0	288	GEV204_R0300_0042	260,93	1375	
155	R03UD2	-1.0	283	GEV204_R0300_0037	259,95	2313	
156	R03UD2	-1.0	277	GEV204_R0300_0031	230,85	62921	

Table 13: Constant amplitude fatigue tests with R=0.1 for geometry R03UD2. In total 57 tests from which 0 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R03UD2	0.1	3752	GEV206_R0300_0340	381,38	39280	
2	R03UD2	0.1	3751	GEV206_R0300_0341	381,33	47130	
3	R03UD2	0.1	3750	GEV206_R0300_0342	381,32	34776	
4	R03UD2	0.1	3749	GEV206_R0300_0343	482,72	4270	
5	R03UD2	0.1	3748	GEV206_R0300_0344	482,7	7348	
6	R03UD2	0.1	3594	GEV206_R0300_0726	399,32	22852	
7	R03UD2	0.1	3593	GEV206_R0300_0728	330,03	71763	
8	R03UD2	0.1	3592	GEV206_R0300_0729	317,5	128482	
9	R03UD2	0.1	3591	GEV206_R0300_0731	315,71	102339	
10	R03UD2	0.1	3590	GEV206_R0300_0732	282,44	556732	
11	R03UD2	0.1	3589	GEV206_R0300_0733	258,51	1010327	
12	R03UD2	0.1	3588	GEV206_R0300_0734	283,11	159510	
13	R03UD2	0.1	3201	GEV206_R0300_0810	229,89	2909837	
14	R03UD2	0.1	3064	GEV206_R0300_0831	286,83	359875	
15	R03UD2	0.1	3056	GEV206_R0300_0882	289,46	462698	
16	R03UD2	0.1	3054	GEV206_R0300_0891	298,90	266028	
17	R03UD2	0.1	3053	GEV206_R0300_0894	289,46	561392	
18	R03UD2	0.1	3052	GEV206_R0300_0906	289,46	109929	
19	R03UD2	0.1	3051	GEV206_R0300_0929	290,27	406588	
20	R03UD2	0.1	2717	GEV206_R0300_0433	270,04	1528090	
21	R03UD2	0.1	2716	GEV206_R0300_0447	267,52	1081746	
22	R03UD2	0.1	1657	GEV206_R0300_0261	500,68	2965	
23	R03UD2	0.1	1656	GEV206_R0300_0262	492,41	2522	
24	R03UD2	0.1	1655	GEV206_R0300_0260	496,50	3722	
25	R03UD2	0.1	1654	GEV206_R0300_0264	399,91	28601	
26	R03UD2	0.1	1653	GEV206_R0300_0248	291,92	255280	
27	R03UD2	0.1	1652	GEV206_R0300_0241	394,24	22067	
28	R03UD2	0.1	1651	GEV206_R0300_0249	293,17	533113	
29	R03UD2	0.1	1650	GEV206_R0300_0263	389,95	18764	
30	R03UD2	0.1	1649	GEV206_R0300_0242	290,94	526177	
31	R03UD2	0.1	1149	GEV206_R0300_0298	210,97	185426	
32	R03UD2	0.1	1148	GEV206_R0300_0299	261,10	330217	
33	R03UD2	0.1	1147	GEV206_R0300_0308	366,68	55253	
34	R03UD2	0.1	1146	GEV206_R0300_0307	579,12	1213	
35	R03UD2	0.1	1145	GEV206_R0300_0305	485,00	5285	
36	R03UD2	0.1	1112	GEV206_R0300_0445	263,48	1278329	
37	R03UD2	0.1	1111	GEV206_R0300_0443	271,18	1830946	
38	R03UD2	0.1	1110	GEV206_R0300_0440	266,19	349482	
39	R03UD2	0.1	1109	GEV206_R0300_0436	562,82	961	
40	R03UD2	0.1	1108	GEV206_R0300_0434	271,53	1812119	
41	R03UD2	0.1	1107	GEV206_R0300_0432	369,74	78760	
42	R03UD2	0.1	958	GEV206_R0300_0498	653,87	202	
43	R03UD2	0.1	957	GEV206_R0300_0496	558,85	976	
44	R03UD2	0.1	956	GEV206_R0300_0446	366,17	72545	
45	R03UD2	0.1	954	GEV206_R0300_0441	372,66	50128	
46	R03UD2	0.1	953	GEV206_R0300_0438	368,26	13010	
47	R03UD2	0.1	952	GEV206_R0300_0435	369,68	60922	
48	R03UD2	0.1	951	GEV206_R0300_0431	375,19	51715	
49	R03UD2	0.1	950	GEV206_R0300_0430	567,04	1065	
50	R03UD2	0.1	949	GEV206_R0300_0429	556,62	836	
51	R03UD2	0.1	948	GEV206_R0300_0428	570,66	440	
52	R03UD2	0.1	945	GEV206_R0300_0212	561,49	1189	
53	R03UD2	0.1	469	GEV206_R0300_0018	341,77	23612	
54	R03UD2	0.1	467	GEV206_R0300_0014	244,12	977128	
55	R03UD2	0.1	466	GEV206_R0300_0013	292,95	226935	
56	R03UD2	0.1	465	GEV206_R0300_0012	341,77	43033	
57	R03UD2	0.1	464	GEV206_R0300_0011	390,60	17403	

Appendix 4 – Constant Amplitude Fatigue Tests R04MD2

Table 14: Constant amplitude fatigue tests with R=2.0 for geometry R04MD2. In total 9 tests from which 3 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	2.0	3148	GEV207_R0400_1043	-390,44	291201	
2	R04MD2	2.0	3147	GEV207_R0400_1089	-329,36	4053760	x
3	R04MD2	2.0	2846	GEV207_R0400_1005	-411,58	424258	
4	R04MD2	2.0	2845	GEV207_R0400_0988	-326,63	1280640	x
5	R04MD2	2.0	2607	GEV207_R0400_0958	-439,75	31042	
6	R04MD2	2.0	2606	GEV207_R0400_0960	-407,48	232329	
7	R04MD2	2.0	2605	GEV207_R0400_0963	-412,59	75101	
8	R04MD2	2.0	2603	GEV207_R0400_0977	-389,47	605452	x
9	R04MD2	2.0	2602	GEV207_R0400_0993	-438,68	5916	

Table 15: Constant amplitude fatigue tests with R=10.0 for geometry R04MD2. In total 34 tests from which 0 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	10.0	2813	GEV207_R0400_1017	-310,56	154108	
2	R04MD2	10.0	2805	GEV207_R0400_1035	-307,97	263886	
3	R04MD2	10.0	2779	GEV207_R0400_1086	-309,15	101563	
4	R04MD2	10.0	2625	GEV207_R0400_0509	-288,62	128583	
5	R04MD2	10.0	2610	GEV207_R0400_0838	-269,13	1346734	
6	R04MD2	10.0	2302	GEV207_R0400_0656	-261,99	99563	
7	R04MD2	10.0	2155	GEV207_R0400_0511	-286,40	20720	
8	R04MD2	10.0	2154	GEV207_R0400_0500	-288,24	76130	
9	R04MD2	10.0	2153	GEV207_R0400_0503	-315,03	5288	
10	R04MD2	10.0	2152	GEV207_R0400_0236	-293,95	217737	
11	R04MD2	10.0	2151	GEV207_R0400_0493	-315,82	4183	
12	R04MD2	10.0	2150	GEV207_R0400_0274	-293,35	99222	
13	R04MD2	10.0	2149	GEV207_R0400_0224	-268,24	76261	
14	R04MD2	10.0	2148	GEV207_R0400_0265	-266,92	2112514	
15	R04MD2	10.0	2147	GEV207_R0400_0619	-270,84	1386586	
16	R04MD2	10.0	2146	GEV207_R0400_0594	-271,56	1429625	
17	R04MD2	10.0	2145	GEV207_R0400_0598	-326,98	153121	
18	R04MD2	10.0	2142	GEV207_R0400_0586	-335,23	27511	
19	R04MD2	10.0	1690	GEV207_R0400_0313	-249,98	10173865	
20	R04MD2	10.0	1689	GEV207_R0400_0314	-350,00	917	
21	R04MD2	10.0	1688	GEV207_R0400_0306	-299,97	4206	
22	R04MD2	10.0	1687	GEV207_R0400_0307	-299,99	16743	
23	R04MD2	10.0	1686	GEV207_R0400_0310	-274,99	231071	
24	R04MD2	10.0	1685	GEV207_R0400_0308	-325,00	2303	
25	R04MD2	10.0	1684	GEV207_R0400_0311	-264,98	4744812	
26	R04MD2	10.0	1683	GEV207_R0400_0312	-337,14	1540	
27	R04MD2	10.0	1682	GEV207_R0400_0301	-294,09	20876	
28	R04MD2	10.0	1681	GEV207_R0400_0302	-269,01	735964	
29	R04MD2	10.0	1680	GEV207_R0400_0304	-339,45	1986	
30	R04MD2	10.0	1679	GEV207_R0400_0303	-293,64	53888	
31	R04MD2	10.0	1678	GEV207_R0400_0300	-297,73	27302	
32	R04MD2	10.0	1677	GEV207_R0400_0565	-277,86	876261	
33	R04MD2	10.0	1676	GEV207_R0400_0309	-294,11	5538	
34	R04MD2	10.0	1675	GEV207_R0400_0298	-271,48	74741	

Table 16: Constant amplitude fatigue tests with R=-2.5 for geometry R04MD2. In total 12 tests from which 2 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	-2.5	3673	GEV207_R0400_0530	119,92	3050	
2	R04MD2	-2.5	3672	GEV207_R0400_0726	99,98	93144	
3	R04MD2	-2.5	3671	GEV207_R0400_0529	110,00	2755	
4	R04MD2	-2.5	3670	GEV207_R0400_0533	60,14	3322798	
5	R04MD2	-2.5	2629	GEV207_R0400_0615	95,23	775565	
6	R04MD2	-2.5	2601	GEV207_R0400_0569	126,08	23701	
7	R04MD2	-2.5	2460	GEV207_R0400_0589	81,18	1460292	
8	R04MD2	-2.5	2459	GEV207_R0400_0787	80,78	1778794	x
9	R04MD2	-2.5	2458	GEV207_R0400_0824	126,30	1041	
10	R04MD2	-2.5	2457	GEV207_R0400_0845	94,88	193151	
11	R04MD2	-2.5	2456	GEV207_R0400_0846	147,16	105	
12	R04MD2	-2.5	2455	GEV207_R0400_0877	67,23	3095164	x

Table 17: Constant amplitude fatigue tests with R=-1.0 for geometry R04MD2. In total 87 tests from which 3 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	-1.0	3738	GEV207_R0400_0203	179,26	275387	
2	R04MD2	-1.0	3737	GEV207_R0400_0204	233,46	26225	
3	R04MD2	-1.0	3736	GEV207_R0400_0205	233,07	20355	
4	R04MD2	-1.0	3735	GEV207_R0400_0206	180,57	169753	
5	R04MD2	-1.0	2869	GEV207_R0400_0708	103,77	596635	
6	R04MD2	-1.0	2847	GEV207_R0400_0875	189,29	22500	
7	R04MD2	-1.0	2624	GEV207_R0400_0479	179,57	1980	
8	R04MD2	-1.0	2623	GEV207_R0400_0472	132,01	1452093	
9	R04MD2	-1.0	2622	GEV207_R0400_0481	180,72	3288	
10	R04MD2	-1.0	2615	GEV207_R0400_0799	186,44	40297	
11	R04MD2	-1.0	2613	GEV207_R0400_0807	189,65	4191	
12	R04MD2	-1.0	2612	GEV207_R0400_0825	139,39	637298	
13	R04MD2	-1.0	2611	GEV207_R0400_0829	240,20	2793	
14	R04MD2	-1.0	2609	GEV207_R0400_0847	187,27	12581	
15	R04MD2	-1.0	2301	GEV207_R0400_0657	180,09	31694	
16	R04MD2	-1.0	2300	GEV207_R0400_0658	179,53	17926	
17	R04MD2	-1.0	2299	GEV207_R0400_0659	132,13	231984	
18	R04MD2	-1.0	2298	GEV207_R0400_0660	133,20	193726	
19	R04MD2	-1.0	2170	GEV207_R0400_0477	226,21	941	
20	R04MD2	-1.0	2169	GEV207_R0400_0495	226,70	6764	
21	R04MD2	-1.0	2168	GEV207_R0400_0498	270,21	3910	
22	R04MD2	-1.0	2167	GEV207_R0400_0499	179,11	41120	
23	R04MD2	-1.0	2166	GEV207_R0400_0486	268,83	410	
24	R04MD2	-1.0	2165	GEV207_R0400_0478	230,19	1256	
25	R04MD2	-1.0	2164	GEV207_R0400_0488	180,23	112810	
26	R04MD2	-1.0	2163	GEV207_R0400_0485	180,40	6412	
27	R04MD2	-1.0	2162	GEV207_R0400_0507	132,88	817473	
28	R04MD2	-1.0	2161	GEV207_R0400_0484	233,35	1510	
29	R04MD2	-1.0	2160	GEV207_R0400_0268	182,79	51545	
30	R04MD2	-1.0	2159	GEV207_R0400_0567	186,58	16768	
31	R04MD2	-1.0	2158	GEV207_R0400_0599	283,57	362	
32	R04MD2	-1.0	2157	GEV207_R0400_0783	137,76	1155325	
33	R04MD2	-1.0	1674	GEV207_R0400_0103	149,96	1822	
34	R04MD2	-1.0	1673	GEV207_R0400_0104	150,14	4595	
35	R04MD2	-1.0	1672	GEV207_R0400_0105	108,43	1590000	x
36	R04MD2	-1.0	1671	GEV207_R0400_0106	124,97	1100000	x
37	R04MD2	-1.0	1670	GEV207_R0400_0107	249,83	959	
38	R04MD2	-1.0	1669	GEV207_R0400_0131	276,42	727	
39	R04MD2	-1.0	1667	GEV207_R0400_0316	234,38	4265	
40	R04MD2	-1.0	1192	GEV207_R0400_0272	103,82	6728478	x
41	R04MD2	-1.0	1073	GEV207_R0400_0063	117,83	2719725	
42	R04MD2	-1.0	1072	GEV207_R0400_0061	117,99	1623268	
43	R04MD2	-1.0	1071	GEV207_R0400_0058	146,43	477127	
44	R04MD2	-1.0	1070	GEV207_R0400_0056	147,65	2570	
45	R04MD2	-1.0	1069	GEV207_R0400_0055	148,49	360314	
46	R04MD2	-1.0	1068	GEV207_R0400_0054	177,49	78055	
47	R04MD2	-1.0	1067	GEV207_R0400_0053	177,75	83510	
48	R04MD2	-1.0	1066	GEV207_R0400_0052	265,39	269	
49	R04MD2	-1.0	1065	GEV207_R0400_0051	263,88	241	
50	R04MD2	-1.0	1064	GEV207_R0400_0050	233,83	402	
51	R04MD2	-1.0	1063	GEV207_R0400_0049	234,12	2091	
52	R04MD2	-1.0	840	GEV207_R0400_0129	184,98	48942	
53	R04MD2	-1.0	839	GEV207_R0400_0124	250,01	1534	
54	R04MD2	-1.0	838	GEV207_R0400_0120	185,03	59468	
55	R04MD2	-1.0	837	GEV207_R0400_0118	200,00	16291	
56	R04MD2	-1.0	836	GEV207_R0400_0117	250,01	2608	
57	R04MD2	-1.0	835	GEV207_R0400_0116	184,98	57038	

58	R04MD2	-1.0	834	GEV207_R0400_0115	124,39	2098460	
59	R04MD2	-1.0	833	GEV207_R0400_0114	175,00	109901	
60	R04MD2	-1.0	832	GEV207_R0400_0113	134,99	735186	
61	R04MD2	-1.0	831	GEV207_R0400_0112	134,99	655532	
62	R04MD2	-1.0	830	GEV207_R0400_0111	150,00	481189	
63	R04MD2	-1.0	829	GEV207_R0400_0110	250,03	2074	
64	R04MD2	-1.0	828	GEV207_R0400_0109	224,98	8234	
65	R04MD2	-1.0	827	GEV207_R0400_0108	134,98	637851	
66	R04MD2	-1.0	718	GEV207_R0400_0229	117,99	15576	
67	R04MD2	-1.0	709	GEV207_R0400_0023	81,20	8238763	
68	R04MD2	-1.0	705	GEV207_R0400_0019	87,54	8463432	
69	R04MD2	-1.0	702	GEV207_R0400_0016	116,71	5074	
70	R04MD2	-1.0	699	GEV207_R0400_0013	146,47	834	
71	R04MD2	-1.0	692	GEV207_R0400_0006	107,84	3857	
72	R04MD2	-1.0	691	GEV207_R0400_0005	105,04	49728	
73	R04MD2	-1.0	689	GEV207_R0400_0003	98,90	102966	
74	R04MD2	-1.0	546	GEV207_R0400_0035	98,99	7223777	
75	R04MD2	-1.0	545	GEV207_R0400_0070	106,57	4646705	
76	R04MD2	-1.0	544	GEV207_R0400_0043	104,98	3055330	
77	R04MD2	-1.0	543	GEV207_R0400_0069	111,49	9009	
78	R04MD2	-1.0	542	GEV207_R0400_0031	117,94	11786	
79	R04MD2	-1.0	541	GEV207_R0400_0032	116,29	8142	
80	R04MD2	-1.0	540	GEV207_R0400_0039	146,58	2923	
81	R04MD2	-1.0	539	GEV207_R0400_0036	145,89	1403	
82	R04MD2	-1.0	538	GEV207_R0400_0037	175,30	1141	
83	R04MD2	-1.0	537	GEV207_R0400_0044	174,18	744	
84	R04MD2	-1.0	536	GEV207_R0400_0040	204,17	443	
85	R04MD2	-1.0	535	GEV207_R0400_0041	263,74	265	
86	R04MD2	-1.0	383	GEV205_R0400_0047	259,01	336	
87	R04MD2	-1.0	378	GEV205_R0400_0042	258,56	168	

Table 18: Constant amplitude fatigue tests with R=-0.4 for geometry R04MD2. In total 28 tests from which 0 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	-0.4	2734	GEV207_R0400_0709	95,44	39393907	
2	R04MD2	-0.4	2608	GEV207_R0400_0953	294,13	3536	
3	R04MD2	-0.4	2297	GEV207_R0400_0281	210,00	62379	
4	R04MD2	-0.4	2295	GEV207_R0400_0457	213,86	103657	
5	R04MD2	-0.4	2294	GEV207_R0400_0458	239,82	36849	
6	R04MD2	-0.4	2293	GEV207_R0400_0459	279,91	14519	
7	R04MD2	-0.4	2292	GEV207_R0400_0460	330,27	2265	
8	R04MD2	-0.4	2291	GEV207_R0400_0461	150,38	2308278	
9	R04MD2	-0.4	2290	GEV207_R0400_0547	168,21	116481	
10	R04MD2	-0.4	2289	GEV207_R0400_0548	183,51	69767	
11	R04MD2	-0.4	2288	GEV207_R0400_0561	159,66	10863	
12	R04MD2	-0.4	2287	GEV207_R0400_0562	225,00	13070	
13	R04MD2	-0.4	2286	GEV207_R0400_0566	249,98	7567	
14	R04MD2	-0.4	2184	GEV207_R0400_0502	295,21	3525	
15	R04MD2	-0.4	2183	GEV207_R0400_0496	227,14	61144	
16	R04MD2	-0.4	2182	GEV207_R0400_0505	161,04	1340381	
17	R04MD2	-0.4	2181	GEV207_R0400_0225	297,94	5253	
18	R04MD2	-0.4	2180	GEV207_R0400_0233	229,65	26422	
19	R04MD2	-0.4	2179	GEV207_R0400_0269	187,04	497640	
20	R04MD2	-0.4	2178	GEV207_R0400_0231	230,78	31877	
21	R04MD2	-0.4	2177	GEV207_R0400_0263	232,75	23001	
22	R04MD2	-0.4	2176	GEV207_R0400_0257	164,40	568162	
23	R04MD2	-0.4	2175	GEV207_R0400_0258	233,99	19593	
24	R04MD2	-0.4	2174	GEV207_R0400_0271	306,53	2084	
25	R04MD2	-0.4	2173	GEV207_R0400_0581	171,23	75607	
26	R04MD2	-0.4	2172	GEV207_R0400_0605	170,84	100679	
27	R04MD2	-0.4	2171	GEV207_R0400_0587	243,91	6878	
28	R04MD2	-0.4	2144	GEV207_R0400_0578	317,73	868	

Table 19: Constant amplitude fatigue tests with R=0.1 for geometry R04MD2. In total 47 tests from which 2 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	0.1	3742	GEV207_R0400_0199	266,57	106030	
2	R04MD2	0.1	3741	GEV207_R0400_0200	266,59	83778	
3	R04MD2	0.1	3740	GEV207_R0400_0201	335,85	9228	
4	R04MD2	0.1	3739	GEV207_R0400_0202	335,87	10930	
5	R04MD2	0.1	3063	GEV207_R0400_0956	193,94	1596710	
6	R04MD2	0.1	3062	GEV207_R0400_1024	192,36	538691	
7	R04MD2	0.1	3061	GEV207_R0400_1031	192,48	672311	
8	R04MD2	0.1	3060	GEV207_R0400_1037	194,03	1148206	
9	R04MD2	0.1	3059	GEV207_R0400_1049	193,10	603609	
10	R04MD2	0.1	3058	GEV207_R0400_1063	191,95	956670	
11	R04MD2	0.1	3057	GEV207_R0400_1080	212,16	138477	
12	R04MD2	0.1	3013	GEV207_R0400_0541	343,06	3058	
13	R04MD2	0.1	2626	GEV207_R0400_0611	273,38	15617	
14	R04MD2	0.1	2616	GEV207_R0400_0768	278,06	14413	
15	R04MD2	0.1	2604	GEV207_R0400_0967	335,66	4504	
16	R04MD2	0.1	2454	GEV207_R0400_0222	326,66	2514	
17	R04MD2	0.1	2453	GEV207_R0400_0512	261,12	73313	
18	R04MD2	0.1	2452	GEV207_R0400_0487	193,87	1495214	
19	R04MD2	0.1	2451	GEV207_R0400_0273	199,36	346505	
20	R04MD2	0.1	2450	GEV207_R0400_0583	273,80	10661	
21	R04MD2	0.1	2449	GEV207_R0400_0597	274,60	10911	
22	R04MD2	0.1	2448	GEV207_R0400_0861	274,21	14445	
23	R04MD2	0.1	2311	GEV207_R0400_0641	196,44	389441	x
24	R04MD2	0.1	2310	GEV207_R0400_0642	195,97	569820	
25	R04MD2	0.1	2309	GEV207_R0400_0643	194,49	536659	
26	R04MD2	0.1	2308	GEV207_R0400_0644	197,59	361994	
27	R04MD2	0.1	2307	GEV207_R0400_0645	195,18	472004	
28	R04MD2	0.1	2306	GEV207_R0400_0646	156,20	1524977	x
29	R04MD2	0.1	2305	GEV207_R0400_0647	264,20	36837	
30	R04MD2	0.1	2304	GEV207_R0400_0648	265,42	6372	
31	R04MD2	0.1	2303	GEV207_R0400_0651	196,56	533920	
32	R04MD2	0.1	2186	GEV207_R0400_0489	263,44	98460	
33	R04MD2	0.1	2185	GEV207_R0400_0592	346,35	2139	
34	R04MD2	0.1	1062	GEV207_R0400_0123	159,99	5167411	
35	R04MD2	0.1	1061	GEV207_R0400_0294	194,98	1023212	
36	R04MD2	0.1	1060	GEV207_R0400_0130	195,00	1550777	
37	R04MD2	0.1	1059	GEV207_R0400_0119	195,27	1529500	
38	R04MD2	0.1	1058	GEV207_R0400_0126	249,98	72213	
39	R04MD2	0.1	1057	GEV207_R0400_0296	259,97	42577	
40	R04MD2	0.1	1056	GEV207_R0400_0121	259,99	57647	
41	R04MD2	0.1	1055	GEV207_R0400_0133	260,02	71242	
42	R04MD2	0.1	1054	GEV207_R0400_0127	299,99	13591	
43	R04MD2	0.1	1053	GEV207_R0400_0125	375,02	1548	
44	R04MD2	0.1	1052	GEV207_R0400_0132	389,99	1177	
45	R04MD2	0.1	1051	GEV207_R0400_0293	390,00	1028	
46	R04MD2	0.1	1050	GEV207_R0400_0295	390,02	995	
47	R04MD2	0.1	1049	GEV207_R0400_0128	400,00	771	

Table 20: Constant amplitude fatigue tests with R=0.5 for geometry R04MD2. In total 15 tests from which 0 are runouts.

No.	Geometry	R-value	Optidat No.	Name	σ_{max} [MPa]	N [-]	runout
1	R04MD2	0.5	3165	GEV207_R0400_0741	213,58	13287026	
2	R04MD2	0.5	3164	GEV207_R0400_0539	276,58	72890	
3	R04MD2	0.5	3163	GEV207_R0400_0538	274,42	82582	
4	R04MD2	0.5	3162	GEV207_R0400_0740	272,31	852309	
5	R04MD2	0.5	3161	GEV207_R0400_0537	355,02	10840	
6	R04MD2	0.5	3160	GEV207_R0400_0534	355,02	8738	
7	R04MD2	0.5	3159	GEV207_R0400_0739	352,31	47983	
8	R04MD2	0.5	3008	GEV207_R0400_0535	274,39	79300	
9	R04MD2	0.5	2628	GEV207_R0400_0613	271,74	93111	
10	R04MD2	0.5	2627	GEV207_R0400_0582	351,71	11410	
11	R04MD2	0.5	2614	GEV207_R0400_0800	204,86	2150910	
12	R04MD2	0.5	2447	GEV207_R0400_0612	278,33	75550	
13	R04MD2	0.5	2446	GEV207_R0400_0791	274,83	153995	
14	R04MD2	0.5	2445	GEV207_R0400_0844	342,78	19411	
15	R04MD2	0.5	2444	GEV207_R0400_0878	348,11	15318	

Appendix 5 – Variable Amplitude Fatigue Tests R03UD2

Table 21: Variable amplitude fatigue tests with geometry R03UD2. In total 18 tests with the Wisper spectrum.

No.	Geometry	Spectrum	Optidat No.	Name	σ_{max} [MPa]	N [-]	Miner	R=0.1	R=-1.0	R=10.0
1	R03UD2	WISPER	3156	GEV206_R0300_0880	381,00	3996801	0.3014	94.36	5.64	0
2	R03UD2	WISPER	3024	GEV206_R0300_0354	365,03	4783996	0.2440	94.32	5.68	0
3	R03UD2	WISPER	3017	GEV206_R0300_0861	374,66	3319644	0.2143	94.32	5.68	0
4	R03UD2	WISPER	3016	GEV206_R0300_0899	376,13	3188805	0.2135	94.33	5.67	0
5	R03UD2	WISPER	3015	GEV206_R0300_0928	349,75	5577893	0.1932	94.30	5.70	0
6	R03UD2	WISPER	2818	GEV206_R0300_0915	469,89	374137	0.1961	95.39	4.61	0
7	R03UD2	WISPER	2774	GEV206_R0300_0872	466,83	1082895	0.5419	94.77	5.23	0
8	R03UD2	WISPER	2771	GEV206_R0300_0884	470,06	512353	0.2690	95.13	4.87	0
9	R03UD2	WISPER	2769	GEV206_R0300_0890	342,82	8744079	0.2526	94.33	5.67	0
10	R03UD2	WISPER	3428	GEV206_R0300_0097	378,90	6188869	0.4435	94.38	5.62	0
11	R03UD2	WISPER	3427	GEV206_R0300_0098	371,15	4052691	0.2408	94.40	5.60	0
12	R03UD2	WISPER	3426	GEV206_R0300_0099	379,23	7980063	0.5766	94.35	5.65	0
13	R03UD2	WISPER	3425	GEV206_R0300_0809	355,52	11463957	0.4609	94.33	5.67	0
14	R03UD2	WISPER	2726	GEV206_R0300_0046	443,18	1500710	0.4613	94.71	5.29	0
15	R03UD2	WISPER	2725	GEV206_R0300_0045	444,34	1463091	0.4551	94.51	5.49	0
16	R03UD2	WISPER	2724	GEV206_R0300_0799	446,66	1451985	0.4736	94.70	5.30	0
17	R03UD2	WISPER	2723	GEV206_R0300_0800	357,72	9175424	0.3902	94.32	5.68	0
18	R03UD2	WISPER	2722	GEV206_R0300_0807	356,78	11032866	0.4579	94.32	5.68	0

Appendix 6 – Variable Amplitude Fatigue Tests R04MD2

Table 22: Variable amplitude fatigue tests with geometry R04MD2. In total 35 tests with the Wisper, Reverse Wisper, Wisperx and Reverse Wisperx spectrum.

No.	Geometry	Spectrum	Optidat No.	Name	σ_{max} [MPa]	N [-]	Miner	R=0.5	R=0.1	R=-0.4	R=-1.0
1	R04MD2	WISPER	3197	GEV207_R0400_1010	248.89	11436226	0.4850	79.75	13.75	5.84	0.67
2	R04MD2	WISPER	3196	GEV207_R0400_1021	262.72	5041089	0.3652	80.92	13.44	5.07	0.56
3	R04MD2	WISPER	3186	GEV207_R0400_0570	282.81	813953	0.1249	82.69	12.80	4.08	0.44
4	R04MD2	WISPER	3135	GEV207_R0400_1015	267.21	7061136	0.6069	81.29	13.30	4.86	0.54
5	R04MD2	WISPER	3023	GEV207_R0400_1039	354.99	460994	0.7067	86.52	11.19	2.10	0.19
6	R04MD2	WISPER	3022	GEV207_R0400_1044	356.19	559042	0.8814	86.50	11.15	2.14	0.21
7	R04MD2	WISPER	3021	GEV207_R0400_1052	280.85	12291879	1.7321	82.22	13.02	4.30	0.47
8	R04MD2	WISPER	3020	GEV207_R0400_1055	354.64	866723	1.2879	86.22	11.36	2.22	0.21
9	R04MD2	WISPER	3019	GEV207_R0400_1068	355.15	825533	1.2530	86.32	11.26	2.21	0.21
10	R04MD2	WISPER	3018	GEV207_R0400_1078	284.50	9705199	1.5566	82.46	12.93	4.16	0.45
11	R04MD2	REVERSE WISPER	3707	GEV207_R0400_0262	242,62	6805284	0.2234	79.09	13.94	6.24	0.73
12	R04MD2	REVERSE WISPER	3625	GEV207_R0400_0868	210,99	21749014	0.1806	75.39	14.72	8.79	1.10
13	R04MD2	WISPERX	3497	GEV207_R0400_0607	287,47	140757	0.1310	68.77	22.58	7.85	0.81
14	R04MD2	WISPERX	3496	GEV207_R0400_0606	289,83	119374	0.1222	69.74	21.94	7.50	0.80
15	R04MD2	WISPERX	3495	GEV207_R0400_0601	324,39	68792	0.2137	72.86	21.07	5.51	0.56
16	R04MD2	WISPERX	3494	GEV207_R0400_0609	363,61	31400	0.3076	76.35	19.58	3.73	0.34
17	R04MD2	WISPERX	3493	GEV207_R0400_0614	279,72	220254	0.1584	68.19	22.50	8.40	0.92
18	R04MD2	WISPERX	3492	GEV207_R0400_0588	287,39	159724	0.1502	69.29	22.20	7.69	0.82
19	R04MD2	WISPERX	3491	GEV207_R0400_0572	367,04	16631	0.1861	78.96	17.57	3.17	0.30
20	R04MD2	WISPERX	3490	GEV207_R0400_0576	322,71	64056	0.1824	71.54	22.03	5.89	0.54
21	R04MD2	WISPERX	3489	GEV207_R0400_0577	273,13	247253	0.1418	67.78	22.47	8.78	0.97
22	R04MD2	WISPERX	3134	GEV207_R0400_1036	247,24	3222248	0.7076	64.58	23.03	11.11	1.29
23	R04MD2	WISPERX	3133	GEV207_R0400_1056	277,04	275130	0.1809	68.10	22.49	8.48	0.93
24	R04MD2	WISPERX	3132	GEV207_R0400_1057	249,26	2094311	0.4973	64.84	22.99	10.91	1.26
25	R04MD2	WISPERX	3131	GEV207_R0400_1083	246,32	2889312	0.6124	64.47	23.03	11.20	1.30
26	R04MD2	REVERSE WISPERX	3954	GEV207_R0400_0727	244,88	1734146	0.3473	64.26	23.07	11.35	1.32
27	R04MD2	REVERSE WISPERX	3953	GEV207_R0400_0717	272,10	130977	0.0712	67.04	22.89	9.05	1.02
28	R04MD2	REVERSE WISPERX	3952	GEV207_R0400_0718	246,95	2008971	0.4357	64.48	23.07	11.16	1.30
29	R04MD2	REVERSE WISPERX	3951	GEV207_R0400_0722	246,36	1286428	0.2727	64.43	23.06	11.21	1.30
30	R04MD2	REVERSE WISPERX	3950	GEV207_R0400_0719	230,52	5542258	0.6251	62.38	23.17	12.90	1.54

31	R04MD2	REVERSE WISPERX	3949	GEV207_R0400_0521	235,97	1940151	0.2730	63.11	23.15	12.29	1.45
32	R04MD2	REVERSE WISPERX	3948	GEV207_R0400_0550	257,45	605543	0.1954	65.70	22.95	10.19	1.16
33	R04MD2	REVERSE WISPERX	3947	GEV207_R0400_0552	285,25	195128	0.1676	68.28	22.66	8.16	0.89
34	R04MD2	REVERSE WISPERX	3692	GEV207_R0400_0517	254,73	1356421	0.3956	65.36	23.00	10.44	1.19
35	R04MD2	REVERSE WISPERX	3690	GEV207_R0400_0523	252,32	1484533	0.3954	65.09	23.03	10.66	1.22

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