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Electric Power Systems and Microgrids  
Electric Power Systems and Microgrids  
Intelligent Energy Systems and Flexible Markets  
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Full Professor Claus Leth Bak

26 years of highly specialized experience within power system and high voltage technology of theoretical, experimental and practical issues. 5 years of engineering practice in transmission systems as well as 21 years of wide teaching and research experience in academia. His teaching has been acknowledged in evaluation studies from both students and industry. He has been nominated as lecturer of the year six times. A very deep research experience within electric power transmission systems, especially related to electric power system transient studies, harmonics, power system protection and high voltage studies related to corona discharge and audible noise phenomena for overhead lines at transmission level. He is an expert in transmission underground cable electric performance.

- He manages the Energy Technology PhD program at the Department of Energy Technology with +130 PhD students <http://www.et.aau.dk/phd/>
- He is as the Head of the Section of Electric Power Systems and High Voltage at the department of Energy Technology and a member of the management team of the department <http://www.et.aau.dk/department/sections/electric-power-systems/>
- He is a member of the PhD board of the faculty of Engineering and Science at Aalborg University
- He is the vice-head of research program "Modern Power Transmission Systems <http://www.et.aau.dk/research-programmes/modern-power-transmission-systems/>
- Chairman of CIGRE Danish National Committee and CIGRE AdCo member

#### CV

- 1989-1992 Bachelor electrical power engineering, Ingeniørhøjskolen Århus Teknikum (stærkstrøm)
- 1992-1994 Master of science in electrical power engineering, Aalborg University (Cand. Polyt.)
- 1994-1999 Nordjyllandsværket power plant and transmission, project manager substations and relays
- 1999-2002 Assistant professor in dept. of Energy Technology
- 2002-2004 Research Associate professor in dept. of Energy Technology
- 2004-2011 Associate professor in dept. of Energy Technology
- 2015 PhD degree "EHV/HV underground cables in the transmission system", Aalborg University.
- 2011-2016 Professor with special responsibilities (MSO) in dept. of Energy Technology
- 2016-present Full Professor in electric power systems and high voltage in dept. of Energy Technology

PhD supervisor for +45 PhD's within Energy Technology. He has supervised 6 industrial PhD's.

MSc supervisor for +50 Masters Theses and +8 Bachelors theses

CIGRE distinguished member 2020.

#### Services

- Main organizer of Cigré 2019 International Symposium in Aalborg, Denmark
- Cigré National committee chair Denmark
- Cigré Study Committee C4 AG1 member
- Cigré study committee B5 member (from 2016)
- Nord-Is technical committee member and session chair
- IEEE Senior Member
- Member of the board of representatives for Energimuseet
- Reviewer for IEEE transactions, Journal of EPSR, IET, CIGRE and conferences (+70 reviews)

Research projects (selected)

- DANPAC II The west coast 400 kV combined OHL/cable line ( 4 MDKK)
- DANPAC power cables for 150 kV and 400 kV transmission) 5 PhD's with Energinet ( 20 MDKK)
- Wind Farm Black Start Service Integration to Assure Resiliency in 100% Renewable Power Systems ( 4 MDKK)
- PoPyFu Power Pylons of the Future ( 26 MDKK, AAU 7 MDKK)
- SALS Smart adaptive load shedding ( 1,5 MDKK)
- HARMONY (together with prof. Blaabjerg as PI) ( 25 MDKK)
- COBRACable with Energinet, TenneT and TUDelft ( 3 MDKK)
- Ensuring Grid Stability and Supply Reliability in a 100% Renewable Electricity Sector in the Faroe Islands, industrial joint degree PhD project with Faroese University and SEV (TSO).
- 4 industrial PhD projects with ORSTED in the field of harmonics in offshore wind power plants and the transmission network ( 6 MDKK)

#### Selected publications

Total number of publications is approximately 355. These are to be found in [http://vbn.aau.dk/da/persons/clus-leth-bak\(731438f0-7c08-4746-81f6-61a32ebf4fad\)/publications.html](http://vbn.aau.dk/da/persons/clus-leth-bak(731438f0-7c08-4746-81f6-61a32ebf4fad)/publications.html)

- 1.A Current-based Differential Technique to Detect Loss of Field in Synchronous Generators, IEEE transactions on power delivery 2019, Hasani, A., Haghighi, F., Silva, F. M. F. D. & Bak, C. L.
- 2.Enabling the Existing Point-to-Point VSC-HVDC Control for Multi-Terminal Operation, 2019 IEEE Power Energy Society General Meeting, Roni Irnawan, Filipe Miguel Faria da Silva, Claus Leth Bak, Nan Qin, Anna Margareta Lindefelt, Alex Alefragkis.
- 3.Electrical Design of a 400 kV Fully Composite Pylon, Tohid Jahangiri, Qian Wang, F. Faria da Silva and Claus Leth Bak, monograph SPRINGER 2019
- 4.DC Grid Control Concept for Expandable Multi-terminal HVDC Transmission Systems, Roni Irnawan, Filipe Miguel Faria da Silva, Claus Leth Bak, Anna Margareta Lindefelt, Alex Alefragkis, Cigré session 2018, Paris.
- 5.Vacuum circuit breaker modelling for the assessment of transient recovery voltages: application to various network configurations, Claus Leth Bak, Alberto Borghetti, Jakob Bærholm Glasdam, Jesper Hjerrild, Fabio Napolitano, Carlo Alberto Nucci and M. Paolone, EPSR 2017.
- 6.Multi-Stage Optimization-Based Automatic Voltage Control Systems Considering Wind Power Forecasting Errors, Nan Qin, Claus Leth Bak, Hans Abildgaard and Zhe Chen, IEEE transactions on power systems, 2017.
- 7.Distance protection of multiple-circuit shared tower transmission lines with different voltages. Part I: Fault current magnitude, Filipe da Silva and Claus Leth Bak, IET GTD, 2017.
- 8.Distance protection of multiple-circuit shared tower transmission lines with different voltages. Part II: Fault loop impedance, Filipe da Silva and Claus Leth Bak, IET GTD, 2017.
- 9.Efficient Approach for Harmonic Resonance Identification of Large Wind Power Plants, E. Ebrahimzadeh, X. Wang, F. Blaabjerg and C. Leth Bak, PEDG 2016, BEST PAPER AWARD
- 10.Assessment of Lightning Shielding Performance of a 400 kV Double-Circuit Fully Composite Pylon, T. Jahangiri, C. Leth Bak, F. Faria da Silva, B. Endahl, J. Holbøll, Cigré General Session 2016
- 11.Distance protection impedance measurement for inhomogeneous multi-circuit 400/150 kV transmission lines with shared towers, DPSP 2016.
- 12.EHV/HV underground cables in the transmission network, PhD thesis, Aalborg University, 2015.
- 13.High Voltage AC underground cable systems for power transmission - a review of the Danish experience, part 1 and part 2, 26 pages in total, C. Leth Bak and F. Faria da Silva, Journal of Electric power System Research, 2016.
- 14.Distance protection of cross-bonded transmission cable-systems, C. Leth Bak and C. Flytkjær Jensen, BEST PAPER AWARD, Developments in Power System Protection, IET DPSP 2014
- 15.Electromagnetic Transients in Power Cables, F. Faria da Silva, C. Leth Bak, book 228 pages, Springer 2013, ISBN 978-1-4471-5235-4
- 16.Statistical Distribution of Energization Overvoltages of EHV Cables, T. Ohno, A. Ametani, C. Leth Bak et al., IEEE transactions on Power Delivery 2013
- 17.Study of Harmonics in Cable-based Transmission Networks, F. Faria da Silva, C. Leth Bak, P. Balle Holst, Cigré 2012
- 18.Derivation of Theoretical Formulas of the Frequency Component Contained in the Overvoltage Related to Long EHV Cables, T. Ohno, C. L. Bak, A. Ametani, W. Wiechowski, T. K. Sørensen, IEEE trans. Power delivery, Vol. 27, no.2, April 2012
- 19.Back-to-Back Energization of a 60kV Cable Network - Inrush Currents Phenomenon by F. Faria da Silva, Claus L. Bak, M. Lind Hansen, 07-2010 Proceedings of the PES General Meeting 2010. IEEE 6 p.
- 20.Field test and simulation of a 400 kV crossbonded cable system, U.S. Gudmundsdottir, B. Gustavsen, C.L. Bak, W. Wiechowski, F. Faria da Silva, I E E E Transactions on Power Delivery 2010.
- 21.Full scale test on a 100 km, 150 kV AC cable, F. Faria da Silva, C.L. Bak, W. Wiechowski, U.S. Gudmundsdottir, Cigré conference Paris 2010.
- 22.Methods to minimize zero-missing phenomena, F. Faria da Silva, C.L. Bak, W. Wiechowski, U.S. Gudmundsdottir, M.R. Knardrupgård, I E E E Transactions on Power Delivery 2010.
- 23.Line differential protection scheme modeling for underground 420 kV cable systems – EMTDC/PSCAD relays modeling, M. Szykiel, C.L. Bak, W. Wiechowski, S. Døllerup, MEPS 2010 symposium.
- 24.Measurements for validation of high voltage underground cable modeling, U.S. Gudmundsdottir, C.L. Bak, W. Wiechowski, K. Søgaard, M.R. Knardrupgård, IPST 2009.
- 25.Overvoltage protection of large power transformers – A real life study case, C.L. Bak, K.E. Einarsdottir, E. Andresson, J.M. Rasmussen, J. Lykkegård, W. Wiechowski, I E E E Transactions on Power Delivery 2008.

26. Analysis and simulation of switching surge generation when disconnecting a combined 400 kV cable/overhead line with shunt reactor, C.L. Bak, W. Wiechowski, K. Søgård, S.D. Mikkelsen, IPST 2007.
27. Overhead line measurements and calculation model for snow and frosty mist, C.L. Bak, S.D. Mikkelsen, C. Jensen, ISH 2005.
28. An improved model for the calculation of the electrical onset in gas insulated medium inhomogeneous gaps, C.L. Bak, B. Bak-Jensen, J.T. Sørensen, ISEI conference, DEIS 2002.