COMPOSABLE, EXPRESSIVE AND PORTABLE MODELING FOR HIGH-PERFORMANCE POWER SYSTEM SIMULATION

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OVERVIEW

This talk will introduce the design of the ANDES software for power system modeling and large-scale stability simulation. The work is motivated to enable the rapid prototyping of practical yet complex stability models for research by reducing the programming efforts. The software design consists of a) an implementation-agnostic modeling layer, b) a high-performance simulation layer, and c) a code generator that bridges the two. The modeling layer enables composable and expressive modeling by using equations, transfer functions and discontinuities. A symbolic toolbox will be used to optimize the equations and calculate the Jacobian elements. To vectorize on hardware, the design choices of data structure and model formulation will be discussed. As an outcome, the IEEEST stabilizer model can be modeled in just 20 lines of Python code, and seven second-generation renewable models are made available among nearly 100 models. Numerical simulations also verify the results with DSATools TSAT. In addition, a proof-of-concept study swaps in a code generator for the Julia language and has achieved high computational performance for the power flow problem.

BIO

Dr. Hantao Cui is an assistant professor with the School of Electrical and Computer Engineering at Oklahoma State University. He was a research assistant professor with CURENT and the Department of EECS at the University of Tennessee, Knoxville, where he received his Ph.D. in 2018. He is the author of ANDES, an open-source tool for power system modeling and analysis, and was the Chief Technologist of the CURENT Large Scale Testbed, which won the 2020 R&D 100 Awards. His research interests include computing, software engineering, dynamic performance, and cybersecurity of energy systems.