SEMINARIUM

Balancing and Emission Minimisation of Gas Turbines

Prof. Lars Imsland
Department of Engineering Cybernetics
NTNU Norway

17 kwietnia 2024, godzina 11:30
C2, sala 429

Developing and deploying renewables in existing energy systems are pivotal in Europe's transition to net-zero emissions. In some of these systems, gas turbines (GTs) are central for balancing purposes. However, a hurdle in minimising emissions of GTs operating in combination with intermittent renewables arises from the reliance on unreliable meteorological forecasts. In this presentation, we present a hierarchical framework for decoupling this operational problem into a balancing and emissions minimisation problem. Balancing is ensured with a high-level stochastic balancing filter (SBF) based on data-driven stochastic grey-box models for the uncertain intermittent renewable. The filter utilises probabilistic forecasting and chance constraints to compute safe bounds, within which a proposed low-level economic predictive controller further minimises emissions of the GTs during operations. As GTs exhibit semi-continuous operating regions, complementarity constraints are utilised to fully exploit each GT's allowed operational range. The proposed method is validated in simulation for a gas-balanced hybrid renewable system with batteries, three GTs with varying capacities, and a wind farm, inspired by present plans on the Norwegian Continental Shelf.

PRELEGENT

Lars Imsland is a professor in control engineering at the Department of Engineering Cybernetics, at the Norwegian University of Science and Technology (NTNU). His current research interests are broadly within theory and application of optimization for control and estimation, with a diverse range of applications. He is an associate editor for IEEE Transactions of Control Systems Technology, and has held visiting positions as University of Stuttgart, Germany, and University of California Santa Barbara, USA.