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Advanced issues of wind turbine modeling and control

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The motivation for this talk proposal comes from a real need to have an overview about the challenges of modeling and control for very demanding systems, such as wind turbine systems, which require reliability, availability, maintainability and safety over power conversion efficiency. These issues have begun to stimulate research and development in the wide control community particularly for these installations that need a high degree of sustainability. Note that this topic represents a key point mainly for offshore wind turbines with very large rotors, since they are characterized by challenging modeling and control problems as well as expensive and safety critical maintenance works. In this case, a clear conflict exists between ensuring a high degree of availability and reducing maintenance times, which affect the final energy cost. On the other hand, wind turbines have highly nonlinear dynamics with a stochastic and uncontrollable driving force as input in the form of wind speed, thus representing an interesting challenge also from the modeling point of view. Suitable control methods can provide a sustainable optimization of the energy conversion efficiency over wider than normally expected working conditions. Moreover, a proper mathematical description of the wind turbine system should be able to capture the complete behavior of the process under monitoring, thus providing an important impact on the control design itself. In this way, the control scheme could guarantee prescribed performance, whilst also giving a degree of tolerance to possible deviation of characteristic properties or system parameters from standard conditions, if properly included in the wind turbine model itself. The most important developments in advanced controllers for wind turbines are addressed and open problems in the areas of modeling of wind turbines are also outlined.

Biography

Silvio Simani has received the Laurea degree in Electronic Engineering in 1996 and PhD in Information Science (Automatic Control) in 2000. Since 2006, he has been an IEEE Senior Member and from 2000 a Member of the SAFEPROCESS Technical Committee. Since 2002, he has been working as an Assistant Professor at the Department of Engineering of the University of Ferrara, Italy. His research interests include fault diagnosis, fault tolerant control and system identification, on which he published about 200 refereed journal and conference papers, as well as three books and chapters.

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