Contribution au Réglage de Correcteurs PI$^{?}$D$^{?}$ d'Ordre Fractionnaire

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Abstract: In this work, a new tuning method for fractional order PI$^{?}$D$^{\mu}$ controller was proposed. This method consists of designing a fractional PI$^{?}$D$^{\mu}$ controller, in unit feedback control loop, such that the closed loop system will be equivalent to the desired model. The reference model used in this work, which is Bode's ideal transfer function, is a widely used function in the fractional order control domain because of its iso-damping property, which is an important robustness feature. Indeed, the five parameters of PI$^{?}$D$^{\mu}$ are derived analytically from step response of theprocess to be controlled and the parameters of the desired system that was selected form design specifications, and therefore, six steps of calculation allows to calculate the five parameters of fractional PI $^{?}$D$^{\mu}$. This analytical formulation make the method more practice and very simple. Illustrative examples were presented to validate this new approach. In the second part of this work is an extension of the proposed tuning method. The proposed strategy consists to apply a self-tuned PI$^{?}$D$^{\mu}$ for controlling a speed of a wind turbine in an electric power production plant. Indeed, by using a linearized model about a specified operating point, the controller's parameters were adjusted, with online implementation of the proposed tuning method, to get robust behavior of closed loop system in term of parameters variation.

Keywords : Bode's ideal function, fractional PI?Dμ controller, iso-damping property, Robustness