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Control structures for multi-machine multi-converter systems with upstream coupling☆

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Abstract

A multi-machine multi-converter system formalism has been proposed to describe systems composed of several electrical machines and converters. This description points out coupling elements, which have to distribute energy. Control structures have already been proposed for systems with downstream coupling. This paper is focused on control structures for systems with upstream coupling. Several solutions can be found by moving control blocks.

Keywords: Drives; Power conversion; Power system control; Power system modelling

1. Introduction

Multi-machine multi-converter systems can be considered as extensions of classical drives. They are used either to extend the field of the power applications or to increase their flexibility and their operating safety. Thus, for some high power applications as the railway traction [1], the manufacturers have developed these kinds of drives for several years. These systems allow energy repartitions along the conversion chains through the coupling of power structures. But, these common physical devices induce some perturbations: over-voltages, instabilities, lower performances, etc.

A specific formalism has been defined to make easier the multi-converter multi-machine system (MMS) analysis [2]. This study is made according to the multi-machine multi-converter system project of a national French GdR (Groupement de Recherche). Different coupling sections can be defined in these

☆ MMS project of GdR ME MS of the CNRS, http://www.univ-lill1.fr/l2ep/web-mms.htm.

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5. Conclusion

A specific formalism has been defined to describe and analyse multi-machine multi-converter systems [2]. First, inversion rules have been previously suggested in order to define control structures for such systems. It has been shown that MMS with downstream coupling need repartition criteria in their control structure [9].

This paper is focused on control structures for upstream coupling device. In order to solve the coupling inversion, a weighting criterion has to define the part of each downstream control reference.

Now, with inversion rules and coupling criteria, a control structure of a MMS can be directly deduced from the MMS representation. Even if other control solutions can be found, this methodology leads quickly to one control solution.

A railway traction system [10] has been studied in order to illustrate the control structure construction. This methodology has been already successfully applied to an electric vehicle [13], a five-phase synchronous machine [14] and wind generation systems [15].

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