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电力电子与电力传动

粒子群与PIDNN控制器在VSC-HVDC中的应用

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摘要：

海上风电场并网柔性直流输电系统中，双闭环PI调节器常用来控制风场侧和电网侧变流器,该方法较为成熟,但存在采用的调节器过多、且参数整定困难等不足。文中以神经网络中间层至输出层的权值作为粒子群寻优参数,采用粒子群(particle swarm optimization，PSO)算法设计PID神经网络(PID neural network，PIDNN)控制器，并将该控制器用于控制海上风电场柔性直流输电变流器。根据PIDNN的结构特点，经过简单改进，即将输入层至中间层的权值设定为定值，这时粒子群只需优化中间层至输出层权值，能够明显减少粒子维数，并提高训练速度。用训练获得的PIDNN控制器代替传统PI调节器，建立变流器控制系统的传递函数，开展仿真研究。结果表明，基于合作粒子群算法的PIDNN控制器与传统PI调节器相比，系统的瞬态和稳态性能有明显提高；与传统PIDNN和PSO方法相比，训练次数明显减少，为实施在线训练奠定了基础，同时，也为海上风电场柔性直流输电变流器提供了一种可行的控制方案。

关键词： 合作粒子群 海上风电场 PID神经网络 柔性直流输电

Application of PSO and PIDNN Controller for VSC-HVDC

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Abstract:

The double closed-loop PI regulator is widely used for the control of wind farm side and grid side converters in the VSC-HVDC system for offshore wind farms. But there are too many PI regulators, so it is difficult to adjust all the parameters. In this paper we designed PID neural network controller combined with particle swarm optimization (PSO). And it was used to control the converters of VSC-HVDC. First simple improvement was carried out based on PIDNN structure characteristic. We set the linking weights of the first two layers as constant values. Only the interlayer and output layer linking weights of PID neural network (PIDNN) were used as the optical parameters of PSO. It reduced dimension of particles and improved training speed obviously. Then the conventional PID controller was replaced with PIDNN controller. Simulation research was carried out based on transfer function of converters control system. Simulation results show that the transient and steady state performance is improved compared with conventional PI controllers. Training times can be reduced significantly compared with conventional PIDNN and PSO algorithm. It lays a foundation for on line training and improves a feasible control strategy for VSC-HVDC.

Keywords: cooperation particle swarm optimization (PSO) offshore wind farm PID neural network (PIDNN) VSC-HVDC

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