The growth of energy demands in recent years has been increasing faster than the expansion of transmission facility construction. This tendency cooperating with the continuous investing on the intermittent renewable energy resources drive the research, development, and construction of HVDC projects to create a more reliable, more affordable, and more environmentally friendly power grid.

The implantation of the HVDC to the AC system is a significant move in the development of the HVDC techniques; the form of DC system is evolving from the point-to-point stand-alone system to the hybrid AC-DC multi-terminal systems.

The dissertation reviews the HVDC technologies, discusses the stability issues regarding the AC and embedded HVDC systems, proposes a novel power oscillation control strategy for the embedded HVDC system to improve the system stability, proposes a voltage droop control scheme for the MTDC grid, and constructs two AC-HVDC test system simulation models: a long distance paralleled AC-HVDC transmission system and a five terminal multi-terminal HVDC system connecting with two ac network
and two wind farms. The simulations are conducted in the PSCAD/EMTDC platform for validity of the concept.