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Analysis of unstable pump characteristics of pump turbines

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Abstract

Pumped storage power plants are key components for delivering ancillary services to the electricity grid and serve as a positive and negative reserve for the growing share of intermittent supply to the grid. These operating modes lead to fast and frequent changes between pumping and generating modes as well as extended operation at off-design conditions. A pump turbine fulfilling such requirements has to sustain stable operation at all given head and discharge conditions of the hydraulic system in which it operates. Recently, ANDRITZ HYDRO has developed several pump turbines of a broad range of specific speed. During these developments, the company intensively studied the saddle-shaped instability of the head curve in pump mode using unsteady computational fluid dynamics (CFD) and model measurements.