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**Large-eddy simulations of a mixed-flow pump at off-design conditions** ANTONIO POSA, The George Washington University, ANTONIO LIPPOLIS, Politecnico di Bari, Italy, ELIAS BALARAS, The George Washington University — Reduced flow-rates in turbopumps produce significant unsteady phenomena, characterized by separation and back-flow. In this study an LES approach coupled with an immersed-boundary methodology is utilized to investigate the changes in the flow physics, when compared to nominal flow-rates. The present methodology has been already validated for the design case through comparison with PIV experiments in the literature. It will be shown that for a reduced flow rate (40% of the design one) separation phenomena are generated on the suction side of the rotor blades and on the pressure side of the stator ones. Significant spanwise non-uniformity is produced in the diffuser channels, with a displacement of the flow towards the hub side and back-flow on the shroud side. The values of turbulent kinetic energy are increased by an order of magnitude at off-design conditions and the main source of turbulence is not anymore the flow from the suction side and the trailing edge of the rotor blades: most turbulence is generated now at the leading edge of the diffuser blades. The increased interaction between rotating and stationary parts implies also a stronger dependence of the flow features on the relative position between impeller and diffuser blades.

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