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Three-dimensional numerical simulations of a thin film falling vertically down the inner surface of a rotating cylinder[1] USMAAN FAROOQ, Imperial College London, JASON STAFFORD, University of Birmingham, UK, CAMILLE PETIT, OMAR MATAR, Imperial College London — A flow in which a thin film flows due to gravity on the surface of a rotating cylinder is investigated. This was performed using high resolution three-dimensional direct numerical simulations and a volume-of-fluid approach to treat the interface. The variation of the Ekman number (Ek), defined to be proportional to the rotation of the cylinder, and has a significant effect on various parameters of the flow. The centrifugal force increases with rotational speed, producing a stabilising effect (Iwasaki and Hasegawa, 1981), supressing wave formation. Key features, such as the transition from a 2D to a more complex 3D wave regime, and the local thickness of the film, are heavily influenced by this stabilisation and are investigated. Furthermore the imposed rotation results in distinct characteristics in the flow such as the development of angled waves due to the resolved velocity in the axial and azimuthal directions. Fast Fourier Transforms of the interface are performed which show how the wavelength and angle of the waves varies with Ek. Simulations have been conducted for a range of Ek to provide detailed insight on how this parameter affects the flow.

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