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Low-order representation of turbulent pipe flow[1] JEAN-LOUP BOURGUIGNON, BEVERLEY MCKEON, California Institute of Technology — A simple model of pipe flow turbulence based on a forcing-response analysis of the Navier-Stokes equations (McKeon *et al.* 2010) is presented and used to investigate the dynamics of the large-scale structures. The model is validated against pipe flow DNS data and naturally leads to a low-order representation of the flow as a sum of traveling waves corresponding to the response modes predicted by the model. The low-order flow representation captures a significant fraction of the turbulence intensity and Reynolds stress in the core of the pipe and is highly correlated to the large-scale structures observed in the DNS data. Furthermore, by considering the forcing modes associated with each response mode in the low-order flow representation the amplification mechanisms sustaining the large-scale structures can be identified.

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