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Transition to turbulence in pulsating pipe flow[1] DUO XU, Friedrich-Alexander-Universitaet Erlangen-Nuernberg, SASCHA WARNECKE, BJOERN HOF, Institute of Science and Technology Austria, MARC AVILA, Friedrich-Alexander-Universitaet Erlangen-Nuernberg — We report an experimental investigation of the transition to turbulence in a pulsating pipe flow. This flow is a prototype of various pulsating flows in both nature and engineering, such as in the cardiovascular system where the onset of turbulence is often possibly related to various diseases (e.g., the formation of aneurysms). The experiments are carried out in a straight rigid pipe using water with a sinusoidal modulation of the flow rate. The governing parameters, Reynolds number, Womersley number α (dimensionless pulsating frequency) and the pulsating amplitude A, cover a wide range $3 < \alpha < 23$ and $0 < A < 1$. To characterize the transition to turbulence, we determine how the characteristic lifetime of turbulent spots (/puffs) are affected by the pulsation. While at high pulsation frequencies ($\alpha > 12$) lifetimes of turbulent spots are entirely unaffected by the pulsation, at lower frequencies they are substantially affected. With decreasing frequency much larger Reynolds numbers are needed to obtain spots of the same characteristic lifetime. Hence at low frequency transition is delayed significantly. In addition the effect of the pulsation amplitude on the transition delay is quantified.

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