Fluids and Space Engineering Seminar

Date: Thursday, January 25, 2024 at 14:15 h
Location: ZARM, Room 1730

The transitional regime of pulsatile pipe flow

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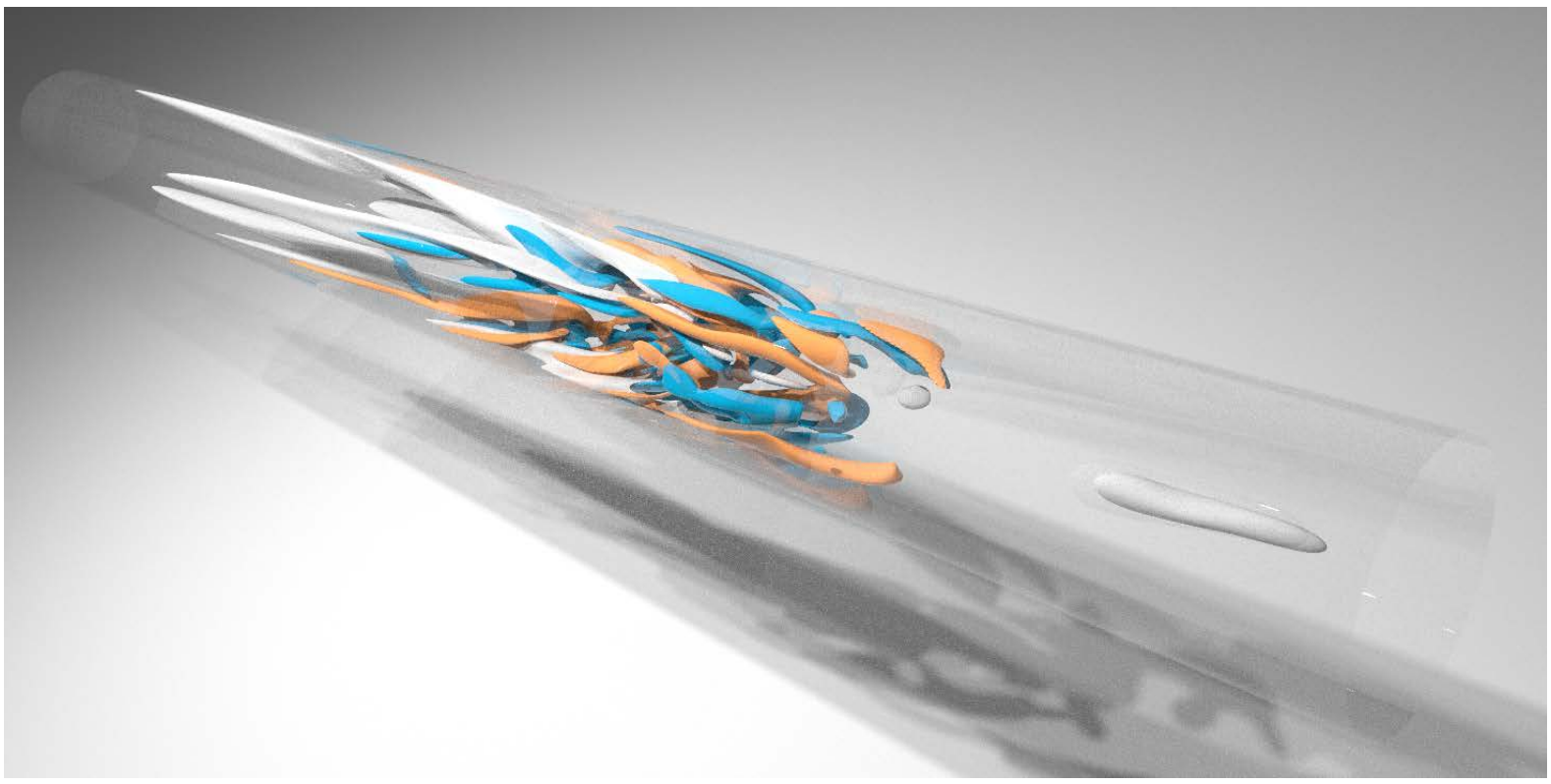

Localized turbulent patch in pulsatile pipe flow

Turbulence is an unpredictable and chaotic fluid motion, that is linked with increased friction and energy losses. It has a huge impact in our day-to-day life, from the prediction of next weeks weather, to your last bumpy flight. Perhaps more importantly, the presence of turbulence in our blood flow has historically been linked with cardiovascular diseases. Turbulence, or irregular flow patterns, exert additional forces in our cardiovascular vessels, leading to injuries and more serious issues. Despite its importance, currently there is no consensus on whether the flow in our arteries is turbulent or not, and if it is, what, out of all the characteristics of blood flow, is the dominant one in terms of turbulent transition. By answering these questions, we could prevent and better treat many cardiovascular diseases.

In this seminar, we consider the 'simplified' case of the flow in a smooth, rigid and cylindrical pipe, as a model of cardiovascular flows. We will explore how such flows transition to turbulence and how turbulence behaves once triggered. First, we will consider the case of a steady driven flow, and then, the case of pulsatile flow, where the bulk velocity oscillates with time. This last case is similar to the blood flow in our arteries that is driven by our beating hearts. It turns out that, by pulsating the flow, it can transition earlier and more abruptly than the steadily driven case. This suggests that transition to turbulence in cardiovascular flows is rooted in the pulsating driving of our hearts.