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ASSESSING PRELOAD AND PRE-STRETCH IMPACT ON HEMODYNAMIC SIMULATIONS

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Abstract. In the last years an increasing interest in patient-specific hemodynamic simulations arised due to the high amount of information these models are able to provide at a low cost and its non-invasive nature. Setting the focus on the modeling of patient-specific three-dimensional arterial blood flow and its effect on the stress state of arterial walls, an important fact that must be taken into account is that image-based geometries obtained from in-vivo studies correspond to a loaded state, resulting from the inner pressure applied by the blood flow and the tethering stresses coming from distant regions of the cardiovascular system.

Even being both facts widely accepted, the literature shows that simulations accounting for the initial inner pressure load generally neglect other relevant aspects, and the mentioned tethering stresses are completely overlooked on patient-specific cases. In this work we show, via two numerical examples, the influence when considering/neglecting these loads in the mechanical behaviour of blood vessels. In order to achieve this, numerical simulations are carried out using an integrative framework capable of considering the key ingredients of hemodynamic modeling: (i) adequate constitutive models (ii) fluid-structure interaction, (iii) proper boundary data over the artificial interfaces for the fluid domain, and (iv) the presence of surrounding tissues in which the vessel is embedded.