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A study of the pulsatile flow and its interaction with rectangular leaflets RENE LEDESMA, ROBERTO ZENIT, GUILLERMO PULOS, Instituto de Investigaciones en Materiales, UNAM, Mexico — To avoid the complexity and limited understanding of the 3D pulsatile flow field through heart valves, a cardiac-like flow circuit and a test channel were designed to study the behavior of bidimensional leaflets made of hyperelastic materials. We study a simple 2D arrangement to understand the basic physics of the flow-leaflet interaction. Creating a periodic pressure gradient, measurements of leaflet deflection were obtained for different flow conditions, geometries and materials. Using PIV and Phase Locking techniques, we have obtained the leaflet motion and the time-dependent flow velocity fields. The results show that two dimensionless parameters determine the performance of a simple bi-dimensional valve, in accordance with the flow conditions applied: Π_1=f(sw)$^{1/2}$(E/ρ)$^{1/2}$ and Π_2=V/(2slw), where f is the pulsation frequency, V is the stroke volume, s, w and l are the dimensions on the leaftlet and E and ρ are the elastic modulus and density of the material, respectively. Furthermore, we have identified the conditions for which the fluid stresses can be minimized. With these results we propose a new set of parameters to improve the performance of prosthetic heart valves and, in consequence, to reduce blood damage.

Rene Ledesma
Instituto de Investigaciones en Materiales, UNAM, Mexico

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