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On the pressure-area relation for the flow in arterial vessels

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For the description of the flow behavior in elastic tubes as arterial vessels, we need a relationship between the Transmural (internal minus external) pressure ptm and the variation in the cross-sectional area A (or diameter), i.e., the pressure-area p A constitutive relation. However, a literature review shows different relations. In this study, the method based on the linear theory of elasticity is revisited. Two relations based on two different degrees of approximations are proposed. Results for the variation of cross-sectional area, arterial compliance Cc and dispensability Di are presented. To define a unique threshold value for the applicability of the former equations, all results are presented in dimensionless form using the parameter of our first equation Beta1 = E h0/R0 (where E is Young's Modulus, h0 and R0 are respectively the vessel wall thickness and the internal radius at ptm = 0). Comparisons with the so-called linear and non-linear p-A equations show that all results are similar for ptm < 0:05. However, the error increases with ptm and at ptm= 0.2, the error with respect to our first equation is equal to 10% and 7:8% respectively for the linear and non-linear relations while it is equal to 26:7% respectively 24:6% with respect to our second equation. Our results indicate that the former equations could be used only for lower values of ptm until 0:08. The application of our first equation to an arterial vessel with ptm = 150 mmHg, showed an increase of 5 % for R0 = 0:8 mm while it is of 30 % for R0 = 6 mm.

Biography

Rafik Absi is engineer from ENP Polytechnic Algiers Algeria in 1994, he received a MSc in Aerothermochemistry from University and INSA of Rouen (France). He completed his PhD in Fluid Mechanics from the University of Caen Basse-Normandie (France) in 2001. After an experience in industry, he joined EBI (France) in 2002 as Lecturer. In 2011, considering his achievements in both Research and Teaching, he received HDR diploma which is the highest academic level in France. His work is mainly in theoretical, analytical and computational modeling of fluid flow related to environmental, industrial and biological applications.

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