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Title of the Thesis : **ARTERIAL ENDOPROSTHESIS: EFFECTS OF BLOOD FLOW AND OPTIMISATION.**

**Abstract:**

In this thesis, we study the behaviour of the outflow of an incompressible viscous Newtonian fluid in large vessels, with the presence of a prosthesis having a nonlinear stress-strain relation. We present a new mathematical approach which allows us to get analytical solutions of the bidimensional flow in elastic stented vessel proportional to the mean axial flow, taking into account the nature (laminar or turbulent) of the flow. Thereafter the one-dimensional model is obtained by averaging the two-dimensional incompressible Navier-Stokes equations over the radius of the vessel. We use the perturbative approach to
solve the final one-dimensional equations, obtaining the final analytical solutions. The numerical simulation then helps to evaluate the effects of the stiffness, nonlinearity of the wall and the viscoelasticity of the stented vessel. We show that the increase of stiffness and nonlinearity of the stented vessel causes the distortions to the level of the swelling zones of prosthesis which contributes to reduce the life span of the stent and damages of the wall.

Using the concept of wave separation, a new technique for the estimation of the characteristics of a good prosthesis inserted in the artery is proposed. The transmission and reflection coefficients due to the prosthesis are determined and the optimal characteristics of a good prosthesis are derived in terms of the geometric and elastic properties of the arterial wall, taking into account the main reflected waves existing in the prosthesis.

**Keywords**: flow in elastic tubes, flow in arteries, blood waves, arterial diseases, perfect endoprosthesis.