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DETERMINING THE CONSTITUTIVE PARAMETERS OF THE HUMAN FEMORAL VEIN IN SPECIFIC PATIENTS

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Abstract. This study suggests a method for computing the constitutive model for veins in vivo from clinically registered ultrasound images. The vein is modelled as a hyperelastic, incompressible, thin-walled cylinder and the membrane stresses are computed using strain energy. The material parameters are determined by tuning the membrane stress to the stress obtained by enforcing global equilibrium.
In addition to the mechanical model, the study also suggests a preconditioning of the pressure-radius signal. The preconditioning computes an average pressure-radius cycle from all consecutive cycles in the registration and removes, or reduces undesirable disturbances. In order to overcome this problem, an approach is proposed that allows constitutive equations to be determined from clinical data by means of reasonable assumptions regarding in situ configurations and stress states of vein walls. The approach is based on a two-dimensional Fung-type stored-energy function that captures the characteristic nonlinear and anisotropic responses of veins.

1 INTRODUCTION

4.5% of the population is at risk of suffering a venous thromboembolism disease, with an approximate mortality rate of 11% ([2, 3]). Our general objective consists of studying a