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A MULTI-LAYERED MODEL FOR THE ANALYSIS OF DRUG RELEASE IN ELUTING STENTS

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The most popular approach for preventing arterial restenosis is based on drug-eluting stents (DES), which combines mechanical properties of traditional stents to the releasing of anti-proliferative drugs into the arterial wall. DES-induced pharmacokinetics through the tissue is studied by means of a one-dimensional model accounting for advection and diffusion mechanisms as well as for bio-chemical reaction phenomena. The model, based on a multi-layered approach includes advection effects related to plasma filtration through the tissues (activated by physiological transmural pressure gradients) and allows to describe mass transfer effects induced by possible plaque occurrence and local hemodynamics. The method of separation of variables is employed, resulting in a Sturm-Liouville problem with discontinuous coefficients, and whose solutions satisfy the orthogonality property in the whole multi-layered domain. A closed-form analytical solution is obtained, in the form of an eigenfunction expansion, leading to a useful and effective tool for a parametric investigation of drug levels and temporal therapeutic windows in clinical treatments.

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