SEMINARIO DE ANÁLISIS NUMÉRICO Y MODELACIÓN MATEMÁTICA - ESTUDIANTES

Centro de Investigación en Ingeniería Matemática (CI^{2}MA), UdeC

Expositor:

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Título de la Charla:

An entropy stable and well-balanced scheme for an augmented blood flow model with variable geometrical and mechanical properties

Fecha y Hora:

Miércoles 13 de Agosto de 2025, 12:15 horas.

Lugar:

Auditorio Hermann Alder Weller, Centro de Investigación en Ingeniería Matemática (CI^{2}MA) - UdeC

Resumen

The flow of blood through a vessel can be described by a hyperbolic system of balance equations for the cross-sectional area and averaged velocity as functions of axial spatial position and time. The variable arterial wall rigidity and the equilibrium cross-sectional area are incorporated within the so-called tube law that gives rise to an internal pressure term. This system can be written as a conservative hyperbolic system for five unknowns. An entropy stable scheme for this augmented one-dimensional blood flow model is developed based on entropy conservative numerical flux. It is proved that the proposed scheme is well-balanced in the sense that it preserves both trivial (zero velocity) and non-trivial (non-zero velocity) steady-state solutions. Several demanding numerical tests show that the scheme can handle various kinds of shocks and preserves stationary solutions when geometrical and mechanical properties of the vessel are variable.

This presentation is based on joint work with Andrés Guerra and Carlos A. Vega (Universidad del Norte, Barranquilla, Colombia).

Referencias

[1] R. Bürger, A. Guerra and C.A. Vega, 'An entropy stable and well-balanced scheme for an augmented blood flow model with variable geometrical and mechanical properties'. Preprint 2025-03, Centro de Investigación en Ingeniería Matemática, Universidad de Concepción; submitted.

[2] L. O. Müller, C. Parés, E. F. Toro, 'Well-balanced high-order numerical schemes for one-dimensional blood flow in vessels with varying mechanical properties', J. Comput. Phys. 242 (2013) 53–85.

[3] L. O. Müller, E. F. Toro, 'Well-balanced high-order solver for blood flow in networks of vessels with variable properties', Int. Numer. Meth. Biomed. Engng. 29 (2013) 1388–1411.