

# Seminario de Análisis Numérico y Modelamiento Matemático SANMoMa - Estudiantes 05-2026



*Stream function – pressure  
virtual element methods for the  
Stokes–Darcy interface problem*

**Miércoles 24 de junio, 12:30 –13:30 horas**

Auditorio 'Hermann Alder Weller'

## **Abstract**

Coupling free fluid flow with porous media flow is crucial for analyzing systems where open channels meet permeable structures. This presentation introduces a novel numerical framework utilizing the Virtual Element Method (VEM) to solve the coupled Stokes–Darcy system. In the free-flow Stokes domain, we implement a stream function formulation that inherently satisfies the incompressibility constraint and reduces computational unknowns. Across the shared interface, mass conservation, normal stress balance, and the Beavers–Joseph–Saffman slip condition are rigorously enforced to couple the biharmonic stream function equation with the Darcy's pressure equation. Taking advantage of VEM's unique ability to handle highly general polygonal meshes, we easily accommodate complex, irregular interface geometries without requiring remeshing or adaptive refinement. The accuracy of the method is validated through several numerical simulations. In particular, we target two distinct applications: dead-end filtration processes and fluid flow networks within bioartificial organs.

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