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Stability of the Euler integration method in coupled two-domain diffusive systems STEFFAN PUWAL[1], BRADLEY ROTH, Oakland University — Owing to its simplicity, the Euler integration method is widely used for modeling diffusive systems. The method involves approximating the derivative with a finite difference. The size of the space and time steps used cannot be considered independently. For the solution to converge, the time step can be no larger than a quantity proportional to the square of the space step; this is the well-known stability condition of the parabolic differential (heat) equation. In cardiac electrodynamics, the action potential reaction diffuses and one must separately consider the diffusive characteristics of the intracellular and extracellular spaces (a bidomain model). We derive the stability relation for this coupled two-domain diffusive system in the case of anisotropic, homogeneous electrical conductivity. We find that stability is uniquely determined only if the electrical conductivity tensors of the two spaces are symmetric (a condition related to the nature of the derivative) and are positive definite (a condition related to entropy).

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