

# Universal Ventricular Coordinates: a new way to transfer Purkinje networks between meshes

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**Introduction:** The representation of the Purkinje System (PS) in biventricular meshes is important for computer simulations of the cardiac electrical activity. Junctions between the PS and myocardium (PMJs) allow the transfer of electrical activity between this network to the entire myocardium. Unfortunately, it is generally not possible to acquire *in vivo* images of PS and given its topological complexity, transferring PSs between meshes is difficult. Universal Ventricular Coordinates (UVCs) are a generic coordinate system for biventricular meshes and allow transferring data between meshes. Thus, they could allow easy transfer of a PS between meshes.

**Aims:** We evaluate the use of UVCs to map a PS between meshes.

**Methods:** We compute UVCs for the source and target meshes. Given the PS in the source mesh, we convert the Cartesian coordinates to UVCs and then convert the UVCs to Cartesian coordinates on the target mesh. When transferring between different species, the penetration depth of the PMJs was accordingly adjusted. The target PS was checked for preservation of topology and time of execution.

**Results:** Computation of UVCs took around 20 minutes for the source mesh and around 10 minutes for the target mesh. The PS of the source mesh had 8293 nodes and 18162 nodes for the PS of the target mesh. It took around 4 seconds to convert to UVCs and around 4 seconds to convert back to Cartesian coordinates. The topology was verified to be correct. Elements that were too long could result in propagation failure, but simply subdividing the elements resolved the issue.

**Conclusion:** UVCs allow accurate transfer of complex PSs between meshes with limited computational demands.

