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On the Estimation of Rotation Axes

LOUIS-PAUL RIVEST

Département de mathématiques et statistique

Université Laval

1045, ave. de la Médecine

Québec, QC G1V 0A6

CANADA

Louis-Paul.Rivest@mat.ulaval.ca

A common problem in biomechanics is to estimate a joint's rotation axis. The axis is expressed as a 3×1 unit vector giving the axis' orientation in a local coordinate system attached to one of the two segments of the joint. Several optimization methods are available for estimating rotation axes. This talk focuses on statistical models to estimate these axes. The data for analysis consists of $SO(3)$ or $SE(3)$ elements giving the time varying posture of the joint. Models featuring one axis and two axes of rotation will be considered. The estimation of the rotation axis of the knee and of the two rotation axes of the ankle will be presented as illustrations.