ABSTRACT
In experiments where observations on each experimental unit are functional in nature, it is often the case that, in addition to variability along the horizontal axis (height or amplitude variability), there are also lateral displacements/deformations in curves (referred to as phase variability). Unlike the former, the latter form of variability is often treated as a nuisance parameter when making inferences. Therefore, it is common in functional data analysis to reduce this variability by aligning curves through a process called curve registration. Often, expert knowledge regarding the location and time that certain curve features occur is available to guide the curve realignment. We propose a Bayesian model that permits incorporating this knowledge when registering curves using a Gaussian process prior formulation. This novel approach capitalizes on the interpolation property of predictive distributions from Gaussian processes while still preserving the flexibility found in modern registration techniques. We detail computational strategies and illustrate the utility of the method through a simulation study and an analysis of knee-power biomechanics.