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Accelerating Time Averaging SERGEI CHERNYSHENKO, Imperial College London, OWEN TUTTY, University of Southampton, HANYING YANG, Imperial College London — Frequently, the goal of numerical modeling of a dynamical system is to obtain the long-time average of a certain parameter, such as, for example, the lift force. Nonlinear systems often exhibit a chaotic behaviour. When the fluctuations are large, obtaining time-averaged quantities with sufficient accuracy requires expensive numerical calculations. We replace the quantity being averaged with another quantity having the same average but fluctuating less. This is achieved using the ideas of the method of bounding time averages (Chernyshenko et al., 2014, Phyl.Trans.Roy.Soc.A, 372). The key idea is that for any differentiable function $V(x)$, where x is the state of the dynamical system, the infinite time average of $dV(x(t))/dt$ is zero provided that $x(t)$ is bounded, which is always the case when infinite time averaging is meaningful. Hence, rather than numerically averaging the quantity of interest, which we will denote F, one can average $F + dV/dt$, for any V. The function $V(x)$ can be optimized so as to accelerate the averaging. So far, this approach was tested on the Lorenz attractor and a two-dimensional flow past a square cylinder, reducing the time required to achieve reasonable accuracy of the average by 10 to 20 %

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