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Approximation methods for future gravitational waveform models: is complexity worth paying for? YOSHINTA SETYAWATI, Max Planck Inst for Gravitational Physics Hannover, MICHAEL PÜRRER, Max Planck Inst for Gravitational Physics Potsdam, FRANK OHME, Max Planck Inst for Gravitational Physics Hannover — The detection and parameter estimation of gravitational waves from compact binary coalescences rely on theoretical models of gravitational wave signals. We highlight that waveform models play an important role in the gravitational-wave science of LIGO and Virgo. Recent developments in waveform modeling aim to build approximate waveforms with an exceptional accuracy against numerical data, but spanning a wider parameter range and with orders of magnitude faster evaluations. Since a relatively small number of numerical simulations are available, various techniques that include interpolation, regression, and even machine learning have been explored in many studies and implemented in different models. We investigate the computational complexity vs accuracy of various techniques such as radial basis function, linear interpolation, tensor product interpolation, polynomial fitting, greedy multivariate polyfit, Gaussian process regression and artificial neural network and their prospect in the future of waveform modelling. We critically evaluate if such complexity are necessary for future waveform modelling and applications in gravitational-wave astronomy.

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