

TFpy: A Python package to analyse and fit time-domain experimental data to transfer function model

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I. INTRODUCTION

At the basis of any time-domain physical experiment – such as Gravitational-wave detection [1]– is often needed to analyse frequency-domain data, frequently presented in the form of a transfer function $H(s)$ for which the phase and amplitude diagrams –the Bode diagrams– are useful. A typical application for the Bode diagrams is to fit the transfer function (TFM) to the experimental data.

The main problem to adress is the complex-valued model shape for the transfer function $H(s)$. Using the phasor notation the frequency ν is expressed as $s = 2\pi\nu \cdot i$, where i is the complex imaginary unit. This way the gain and phase are implicitly obtained from the transfer function, which in itself can be represented in the complex value notation

$$H(s) = |H(s)| \exp[i\phi(s)].$$

[1] D. M. Macleod, J. S. Areeda, S. B. Coughlin, T. J. Massinger, and A. L. Urban, GWpy: A Python package for gravitational-wave astrophysics, *SoftwareX* **13**,

100657 (2021).

[2] T. T. L. Tsan, Kontrol, documentation available kontrol.readthedocs.io.

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