

## Neutron Star Dynamics under Time Dependent External Torques

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The two component (or multicomponent) neutron star models for neutron star dynamics are conventionally solved for external torques that are constant on dynamical timescales of the neutron star interior. These models are applicable for pulsar glitch dynamics. We present the solution for two component neutron star models, for linear coupling (eg mutual friction between the superfluid interior and the crust), as well as nonlinear coupling (nonlinear regime of vortex creep) under arbitrary time dependent external torques. These solutions are applied to extract the spin-up or spin-down behaviour of neutron stars under external torque noise, power law external torques or post-burst exponential decay of the external torque, as relevant for accreting neutron stars and magnetars as well as pulsars.

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