

Project I

Task: Build a second-order generalized integrator (SOGI) model in Matlab/Simulink or other software.

Scores: 20% of the total grades

Simulation Requirements:

The simulation should contain:

- (1) SOGI model (one signal input port and two signal output ports)
- (2) Frequency estimator
- (3) Select the SOGI's parameters according to the linearization analysis
- (4) Testing the model under the following conditions:

- (4.1) Input signal: a sine/cosine signal with frequency at $2\pi \cdot 50$ rad/s and amplitude of 300 V. Check the two output orthogonal signals, and estimation results of amplitude, phase, and frequency.

- (4.2) Input signal: a sine/cosine signal with the initial frequency at $2\pi \cdot 50$ rad/s, but its frequency increases to $2\pi \cdot 60$ rad/s at 1 second. Its initial amplitude is 300 V but increases to 400 V at 2 seconds. Check the two output orthogonal signals, and estimation results of amplitude, phase, and frequency.

Report Requirements:

The report should contain

- (1) The theoretical introduction of the SOGI;
- (2) Derivation process of the linearized SOGI and parameter selection scheme;
- (3) Draw figures of ALL required simulation results;
- (4) Conclusions. **Simulation files should be uploaded together with the report.**

Tips: The integrator of the frequency estimator of the SOGI in Simulation needs an initial value, as the linearization is analyzed with the assumption of small frequency variation. $2\pi \cdot 40$ rad/s can be set as the initial integrator value. **Plagiarism Prohibited. Otherwise, the course will be Failed.**

Contact: Teaching Assistant for help or inquiries.

Due Date: 23:59pm, October 14, 2025. No scores if submitted overdue.