Double Blinder Out-of-Step Relay

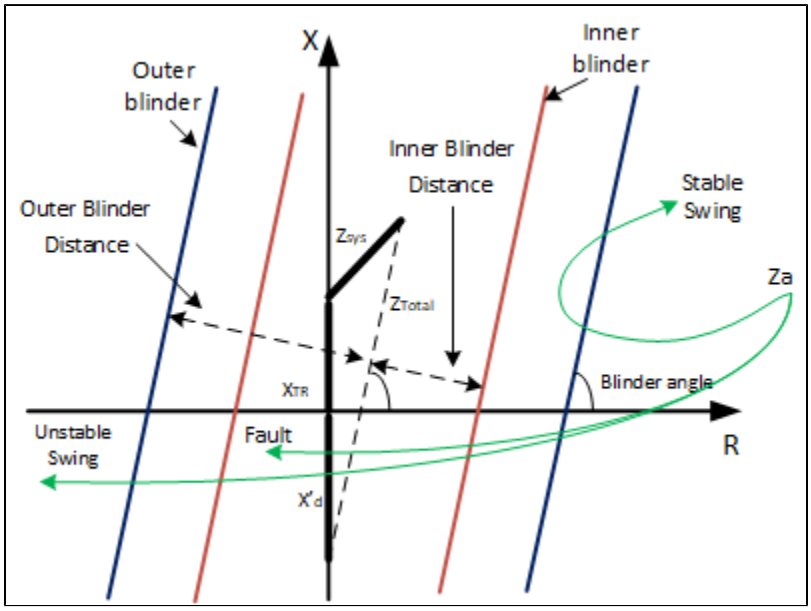
Introduction

The double blinder OOS (out of step) relay is based on the conventional rate of change of impedance method in order to differentiate a stable and an unstable power swing (out-of-step) using positive sequence impedance.

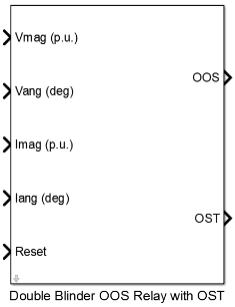
As shown in the figure below, the relay characteristic consists of two parallel blinders on the impedance plane that are used to detect the rate of change of impedance during any disturbance. The idea is based on the fact that the rate of change of impedance is faster during fault compared to that during power swing.

A timer is triggered when the impedance trajectory enters the outer blinder to measures the time spent between the inner and outer blinders. If this time exceeds a predetermined threshold, known as PSB time delay, it is determined as a power swing.

Once a power swing is detected, if this trajectory enters the inner blinder, it is identified as an unstable swing, whereas, if it leaves the outer blinder without entering the inner blinder, it is identified as a stable swing, as shown in the figure below. The relay out-of-step trip (**OST**) logic can be implemented for unstable swing to trip when the positive impedance trajectory either enters the inner blinder zone (between inner blinders), known as Trip On-The-Way-In (**TOWI**), or exits the inner blinder zone knows as Trip On-The-Way-Out (**TOWO**).



Model Description

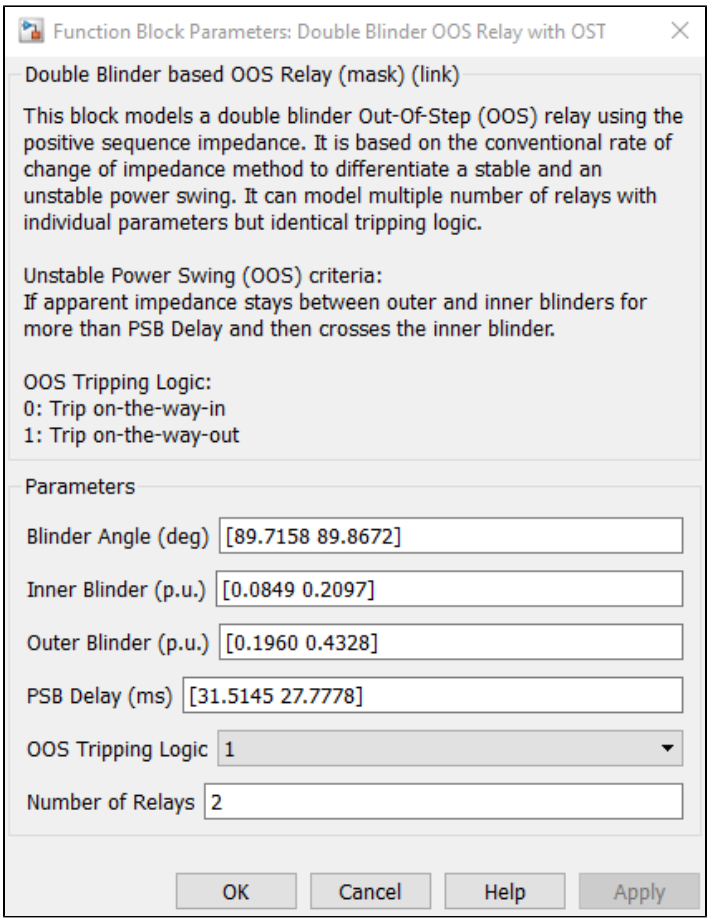


Input	In order to calculate the positive sequence impedance trajectory, the OOS relay requires the voltage and current magnitude (p.u.) as well as angle (deg). When the impedance trajectory is not between the inner blinder, **Reset** =1 will reset the **OOS** and **OST** outputs to the Normal Condition as shown in the Relay Logic table below.
Output	The **OST** trip signal is inverse of the **OOS** signal to make it compatible with the I/O 'status' pin of Positive Sequence Components. When an unstable swing is detected, the outputs change from Normal Condition to OOS Detection as per the following Relay Logic table. The OOS Detection state can be reset to Normal Condition using **Reset** =1 when impedance trajectory is outside the inner blinders.

Relay Logic

State	OOS	OST
Normal Condition	0	1
OOS Detection	1	0

Settings



The settings for the OOS relay is summarized as follows:

Blinder Angle (deg)	The blinder angle of inclination in degrees (refer to relay characteristic figure above).
Inner Blinder (p.u.)	The perpendicular distance of inner blinder from Z_{Total} (refer to relay characteristic figure above).

Outer Blinder (p.u.)	The perpendicular distance of outer blinder from Z_{Total} (refer to relay characteristic figure above).
PSB Delay (ms)	The threshold time delay to distinguish between fault and power swing.
OOS Tripping Logic	This can be set to either '0' or '1'. The **OST** trip signal gets activated during unstable swing according to set value. 0 : when impedance trajectory enters the inner blinder zone (**TOWI**) 1 : when impedance trajectory leaves the inner blinder zone (**TOWO**)
Number of Relays	Specifies the number of relays to be modeled. This relay model can take vector inputs, and thus, can be used as more than one relay.

Example

See inside the subsystem **Power System Protection Relays** in demo PHASOR-02.