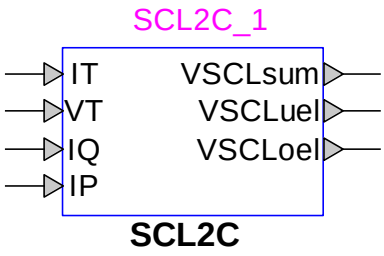
Exciters and Governors: Stator Current Limiter SCL2C



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1 Description

This device is an implementation of the IEEE type SCL2C stator current limiter model. This device is implemented as described in [1]. Implementation details can be viewed by inspecting the subcircuit of this device.

1.1 Pins

This device has 7 pins:

Pin name	Type	Description	Units
IT	Input	Magnitude of the stator current of the generator	pu
VT	Input	Magnitude of the voltage of the generator terminal	pu
IQ	Input	Magnitude of the stator reactive current of the generator	pu
IP	Input	Magnitude of the stator active current of the generator	pu
VSCLsum	Output	Stator Current Limiter signal (summation)	pu
VSCLuel	Output	Stator Current Limiter signal (underexcited region)	pu
VSCLoel	Output	Stator Current Limiter signal (overexcited region)	pu

1.2 Parameters

The default set of parameters can be found in [1].

1.2.1 Data tab

The parameters on the Data tab are:

1. **Time constant T_{B1OEL}**: overexcited regulator denominator (lag) time constant 1
2. **Time constant T_{C1OEL}**: overexcited regulator numerator (lead) time constant 1
3. **Time constant T_{B2OEL}**: overexcited regulator denominator (lag) time constant 2
4. **Time constant T_{C2OEL}**: overexcited regulator numerator (lead) time constant 2
5. **Gain K_{POEL}**: overexcited PID regulator proportional gain
6. **Gain K_{IOEL}**: overexcited PID regulator integral gain
7. **Gain K_{DOEL}**: overexcited PID regulator differential gain
8. **Time constant T_{DOEL}**: overexcited PID regulator differential time constant
9. **Maximum output $V_{OELmax3}$**: maximum OEL PID output limit
10. **Minimum output $V_{OELmin3}$**: minimum OEL PID output limit
11. **Maximum output $V_{OELmax2}$**: maximum OEL lead-lag 1 output limit
12. **Minimum output $V_{OELmin2}$**: minimum OEL lead-lag 1 output limit
13. **Maximum output $V_{OELmax1}$**: maximum OEL output limit
14. **Minimum output $V_{OELmin1}$**: minimum OEL output limit
15. **Time constant T_{B1UEL}**: underexcited regulator denominator (lag) time constant 1
16. **Time constant T_{C1UEL}**: underexcited regulator numerator (lead) time constant 1
17. **Time constant T_{B2UEL}**: underexcited regulator denominator (lag) time constant 2
18. **Time constant T_{C2UEL}**: underexcited regulator numerator (lead) time constant 2
19. **Gain K_{PUEL}**: underexcited PID regulator proportional gain
20. **Gain K_{IUEL}**: underexcited PID regulator integral gain
21. **Gain K_{DUEL}**: underexcited PID regulator differential gain
22. **Time constant T_{DUEL}**: underexcited PID regulator differential time constant
23. **Maximum output $V_{UELmax3}$**: maximum UEL PID output limit
24. **Minimum output $V_{UELmin3}$**: minimum UEL PID output limit
25. **Maximum output $V_{UELmax2}$**: maximum UEL lead-lag 1 output limit
26. **Minimum output $V_{UELmin2}$**: minimum UEL lead-lag 1 output limit
27. **Maximum output $V_{UELmax1}$**: maximum UEL output limit
28. **Minimum output $V_{UELmin1}$**: minimum UEL output limit
29. **Reset-reference I_{reset}**: SCL reset-reference, if inactive
30. **Activation delay time T_{enOEL}**: overexcited activation delay time
31. **Activation delay time T_{enUEL}**: underexcited activation delay time
32. **Reset delay time T_{off}**: SCL reset delay time
33. **Reset threshold value I_{THoff}**: SCL reset threshold value
34. **Time constant T_{IQoel}**: overexcited reactive current time constant
35. **Scaling factor K_{IQoel}**: overexcited reactive current scaling factor
36. **Time constant T_{IPoel}**: overexcited active current time constant
37. **Scaling factor K_{IPoel}**: overexcited active current scaling factor
38. **Time constant T_{IQUel}**: underexcited reactive current time constant
39. **Scaling factor K_{IQUel}**: underexcited reactive current scaling factor
40. **Time constant T_{IPUel}**: underexcited active current time constant
41. **Scaling factor K_{IPUel}**: overexcited active current scaling factor
42. **Time constant T_{ITscl}**: stator current transducer time constant
43. **SCL thermal reference I_{TFpu}**: SCL thermal reference for inverse time calculations
44. **Maximum field current I_{inst}**: SCL instantaneous stator current limit
45. **UEL current limit $I_{instUEL}$**: underexcited region instantaneous stator current limit
46. **Current limit I_{lim}**: SCL thermal stator current limit
47. **Time constant T_{ASCL}**: SCL reference filter time constant
48. **Exponent C_1**: SCL exponent for calculation of $I_{ERRinv1}$
49. **Gain K_1**: SCL gain for calculation of $I_{ERRinv1}$
50. **Exponent C_2**: SCL exponent for calculation of $I_{ERRinv2}$
51. **Gain K_2**: SCL gain for calculation of $I_{ERRinv2}$
52. **Maximum output V_{INVmax}**: SCL maximum inverse time output
53. **Minimum output V_{INVmin}**: SCL minimum inverse time output
54. **Delay time Fixed$_{RU}$**: SCL fixed delay time output
55. **Cooling-down Fixed$_{RD}$**: SCL fixed cooling-down time output

56. **Timer reference T_{SCL}**: SCL timer reference
57. **Timer maximum level T_{max}**: SCL timer maximum level
58. **Timer minimum level T_{min}**: SCL timer minimum level
59. **Gain K_{FB}**: SCL timer feedback gain
60. **Ramp-down rate K_{RD}**: SCL reference ramp-down rate
61. **Ramp-up rate K_{RU}**: SCL reference ramp-up rate
62. **Reference release threshold K_{ZRU}**: SCL thermal reference release threshold
63. **Time constant T_{VTSCL}**: terminal voltage transducer time constant
64. **Minimum voltage reference V_{Tmin}**: SCL_{OEL} minimum voltage reference value
65. **Voltage reset V_{Treset}**: SCL_{OEL} voltage reset value
66. **Minimum reactive current reference $I_{QminOEL}$**: SCL_{OEL} minimum reactive current reference value
67. **Maximum reactive current reference $I_{QmaxUEL}$**: SCL_{UEL} maximum reactive current reference value
68. **Reference scaling factor K_{Pref}**: SCL reference scaling factor based on active current
69. **OEL Ramp Rate Logic Switch option**: see explanations below.

There are two possible selections for the OEL Ramp Rate Logic Switch option:

1. Fixed ramp rated.
2. Ramp rate function of the field current error

2 Initial conditions

The SCL is supposed to be inactive during the steady-state conditions.

3 References

[1] “IEEE Recommended Practice for Excitation System Models for Power System Models for Power System Stability Studies,” IEEE Standard 421.5-2016.