Development notes for IVM in pstV2p3 (and pstV3p1)

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June 2019

# Intro

pstV2p3 is a modified version of pstV2p2. It adds “Internal Voltage Model” generator type. The IVM is a voltage behind impedance model. The interface model is in Figure 1 where VT is the terminal voltage. Internal voltage magnitude E and angle δ are calculated via a user defined model.

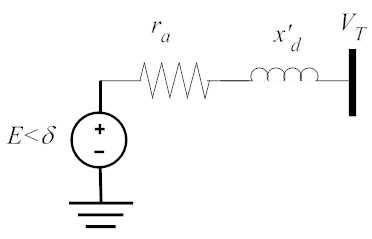


Figure 1: IVM Interface model.

# Strategy

1. Declare the injection bus (VT above) as a type 2 generator bus.
2. Add a new machine type to mac\_con called “Internal Voltage Model”. Definitions are

% Machine data format

% Column

% 1. machine number (may be different from bus number),

% 2. bus number,

% 3. machine base mva,

% 4. Not used

% 5. resistance r\_a(pu)

% 6. 0

% 7. d-axis transient reactance x'\_d(pu)

% 8. 0

% 9. Td = inverter delta time constant (sec.)

% 10. Tv = inverter voltage magnitude time constant (sec.)

% 11. Not used

% 12. Not used

% 13. Not used

% 14. Not used

% 15. Not used

% 16. inertia constant H(sec), currently not used

% 17. Not used

% 18. Not used

% 19. bus number

% 20. Not used

% 21. Not used

1. New global variables
   * mac\_ivm\_idx = indices (rows of mac\_con) corresponding to an ivm type. If isempty(mac\_ivm\_idx), then no IVMs exist.
   * n\_ivm = number of IVM generators.
   * ivmmod\_data = storage variable for ivmmod\_dyn.m
2. Code edits

* Function pst\_var.m: Added mac\_ivm\_idx, n\_ivm, ivmmod\_data, ivmmod\_d\_sig, and ivmmod\_e\_sig definitions near line 74.
* Function mac\_indx.m: Added mac\_ivm\_idx and n\_ivm calculations to lines 81 thru 86.
* Created new function mac\_ivm.m: models the IVM as:

Referring to Fig 1, where

in Fig 1

in Fig 1

* Function ivmmod\_dyn.m to set up ivmmod\_d\_sig and ivmmod\_e\_sig. This function is user defined and allows for dynamics.
* s\_simu\_batch.m: Several modifications:
  + Added ivmmod\_d\_sig and ivmmod\_e\_sig initialization near lines 347-354
  + Added model initialization near lines 438 and 448-465.
  + Added ivm network interface near line 604.
  + Added ivmmod state derivative calculations and defining ivmmod\_d\_sig nad ivmmod\_e\_sig near lines 829-853.
  + Added ivmmod state udates near lines 917 to 922.
  + Added mac\_ivm network interface calc near line 933.
  + Added ivmmod state derivative calculations and defining ivmmod\_d\_sig nad ivmmod\_e\_sig near lines 1141-1164.
  + Added ivmmod state udates near lines 1235-1240.