# indmc1_e.ebe

## Attributes

```
ebe name=indmc1_e x_inputs=yes x_outputs=yes allow_elex=no
Jacobian: variable
nodes: a b c
state_vars:
aux_vars:
+  ids
+  idr
+  iqs
+  iqr
+  psids
+  psidr
+  psiqs
+  psiqr
+  wr
+  tem
+  vds
+  vqs
aux_vars_startup:
+  psids_st
+  psidr_st
+  psiqs_st
+  psiqr_st
+  ids_st
+  iqs_st
elex_aux_vars:
x_vars: wrm tl
iparms:
+  poles=4
sparms:
rparms:
+  rs=1.157
+  lls=6.2m
+  lm=139m
+  llr=6.2m
+  rr=1.157
+  j=0.25
+  le=0
+  l1=0
+  l2=0
+  x1=0
+  x2=0
stparms:
+  psids0=0
+  psidr0=0
+  psiqs0=0
+  psiqr0=0
+  ids0=0
+  iqs0=0
+  wrm0=0
igparms:
n_sw_states: 0
sw_type: none
outparms: ia ib ic va vb vc tem wrm
```

## Description

`indmc1_e.ebe` is a 3=phase induction machine model with nodes `a`, `b`, `c`. The model equations are given by

$$i_a = i_{qs} \, ,$$

$$i_b = -\frac{1}{2} i_{qs} - \frac{\sqrt{3}}{2} i_{ds} \, ,$$

$$i_c = -\frac{1}{2} i_{qs} + \frac{\sqrt{3}}{2} i_{ds} \, ,$$

$$v_{qs} = \frac{2}{3} V_a - \frac{1}{3} (V_b + V_c) \, ,$$

$$v_{ds} = -\frac{1}{\sqrt{3}} (V_b - V_c) \, ,$$

$$i_{ds} = \frac{l_r}{l_m l_e} \psi_{ds} - \frac{1}{l_e} \psi_{dr} \, ,$$

$$i_{dr} = \frac{1}{l_m} \psi_{ds} - \left( \frac{l_{ls}}{l_m} + 1 \right) i_{ds} \, ,$$

$$i_{qs} = \frac{l_r}{l_m l_e} \psi_{qs} - \frac{1}{l_e} \psi_{qr} \, ,$$

$$i_{qr} = \frac{1}{l_m} \psi_{qs} - \left( \frac{l_{ls}}{l_m} + 1 \right) i_{qs} \, ,$$

$$T_{em} = \frac{3}{4} l_m \left( i_{qs} i_{dr} - i_{ds} i_{qr} \right) \, ,$$

$$\omega_r = \frac{P}{2} \omega_{rm} \, ,$$

$$\frac{d\psi_{ds}}{dt} = v_{ds} - r_s i_{ds} \, ,$$

$$\frac{d\psi_{qs}}{dt} = v_{qs} - r_s i_{qs} \, ,$$

$$\frac{d\psi_{dr}}{dt} = -\omega_r \psi_{qr} - r_r i_{dr} \, ,$$

$$\frac{d\psi_{qr}}{dt} = \omega_r \psi_{dr} - r_r i_{qr} \, ,$$

$$\frac{d\omega_{rm}}{dt} = \frac{P}{2} \frac{T_{em} - T_L}{J} \, .$$

The terminal currents, terminal voltages (with respect to an external reference node), electromagnetic torque, and angular frequency are made are made available as output variables.