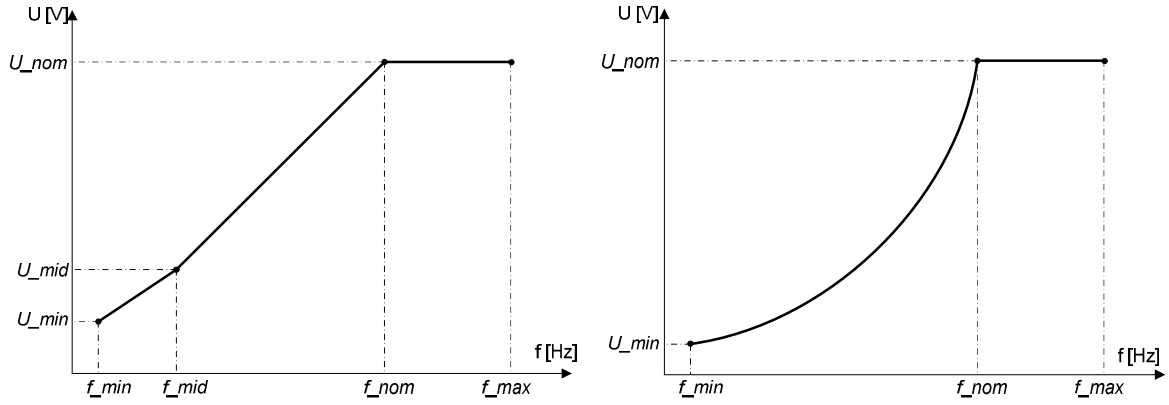
Instruction of simulation exercise

Scalar Control of Squirrel-Cage Induction Motor

The aim of the exercise is to get familiar with scalar control method of squirrel-cage induction motor and influence of V = f(f) characteristic shape on drive system properties. The simulation model includes:

- *Control system* – includes frequency setpoint block *freq_prof*, frequency change rate block *Freq_ramp* and V = f(f) characteristic shape block *V/f characteristic*,
- *Scopes* – allows visualisation of space vectors of currents, voltages and fluxes (*Space vectors* block). *CONST.1* selects coordinate system: 0 – rotating, 1 - stationary.

Parameter *type* (CONST.26) of *V/f characteristic* block selects the characteristic type: 0 – linear characteristic, 1 – square characteristic V = f(f^2). Parameter *f_max* (*CONST.10*) determines the maximum output frequency. Parameters determining the shape of V = f(f) characteristic are visible in the picture below.



Plan of the exercise

1. Choose the linear characteristic and set the following parameters values: *f_min* = 2Hz, *U_min* = 18V, *f_mid* = 10Hz, *U_mid* = 80V, *f_nom* = 50Hz, *U_nom* = 400V, *f_max* = 100Hz. Run the simulation for three different values of frequency setpoint (eg. 45 Hz, 25 Hz, 5 Hz). For every value of the frequency, change the load torque value (eg. 10%, 50%, 90%) and observe the stator current, stator flux and speed. Comment the obtained results.

2. For the motor operation with frequency equal to 5Hz change the load torque value from 0 to 100% and observe the motor speed. Change the *U_min* value to get the constant speed at steady state. Comment the obtained results.

3. Reset the value of *U_min* parameter. For the load torque value equal to 0% and 20% measure the values of motor current, flux and speed for the torque setpoint values equal to 10Hz, 30Hz and 50Hz. Then choose the square characteristic and repeat the measurements. Compare the results and draw conclusions.

4. Choose the linear characteristic. Observe the transient during the starting proces for no-load operation and frequency setpoint equal to 25Hz. For steady state change the load torque (eg. 80% and -80%) and observe the transients of electrical and mechanical quantities. Observe relative positions of space vectors of current, voltage and stator flux in rotating coordinate system (*Space vectors* block). Comment the obtained results.