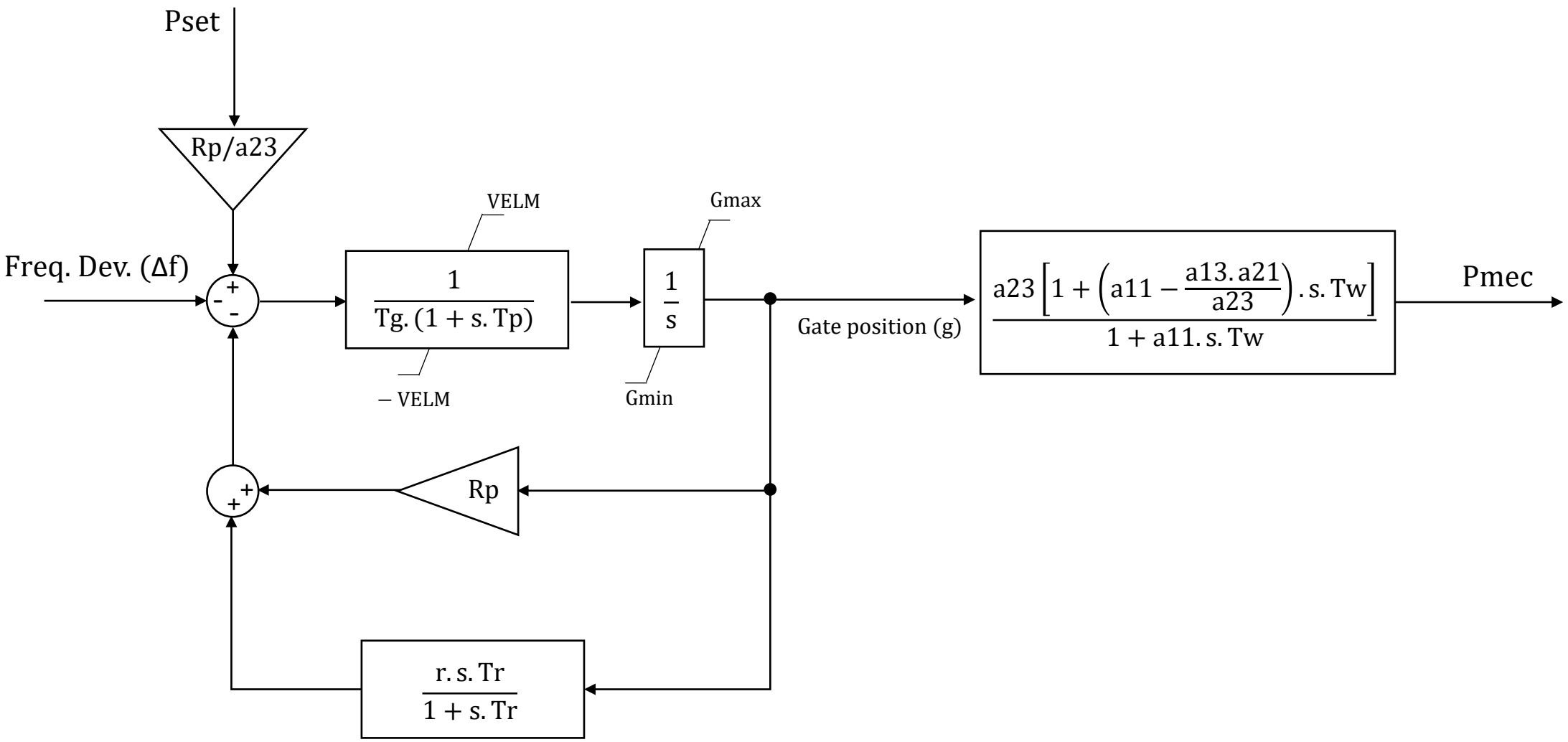
Alqueva – Fixed speed model (with and without SPPS)

Block Diagram for aFRR provision (based on IEEEG3 model)



Alqueva – Fixed speed model (with and without SPPS)

Model's input signals, output signals and parameters

Input signals:

- Δf – grid frequency deviation from setpoint, given by fgrid - fset (p.u.)
- Pset – active power setpoint (p.u.)

Output signals:

- Pmec – mechanical power (p.u.)

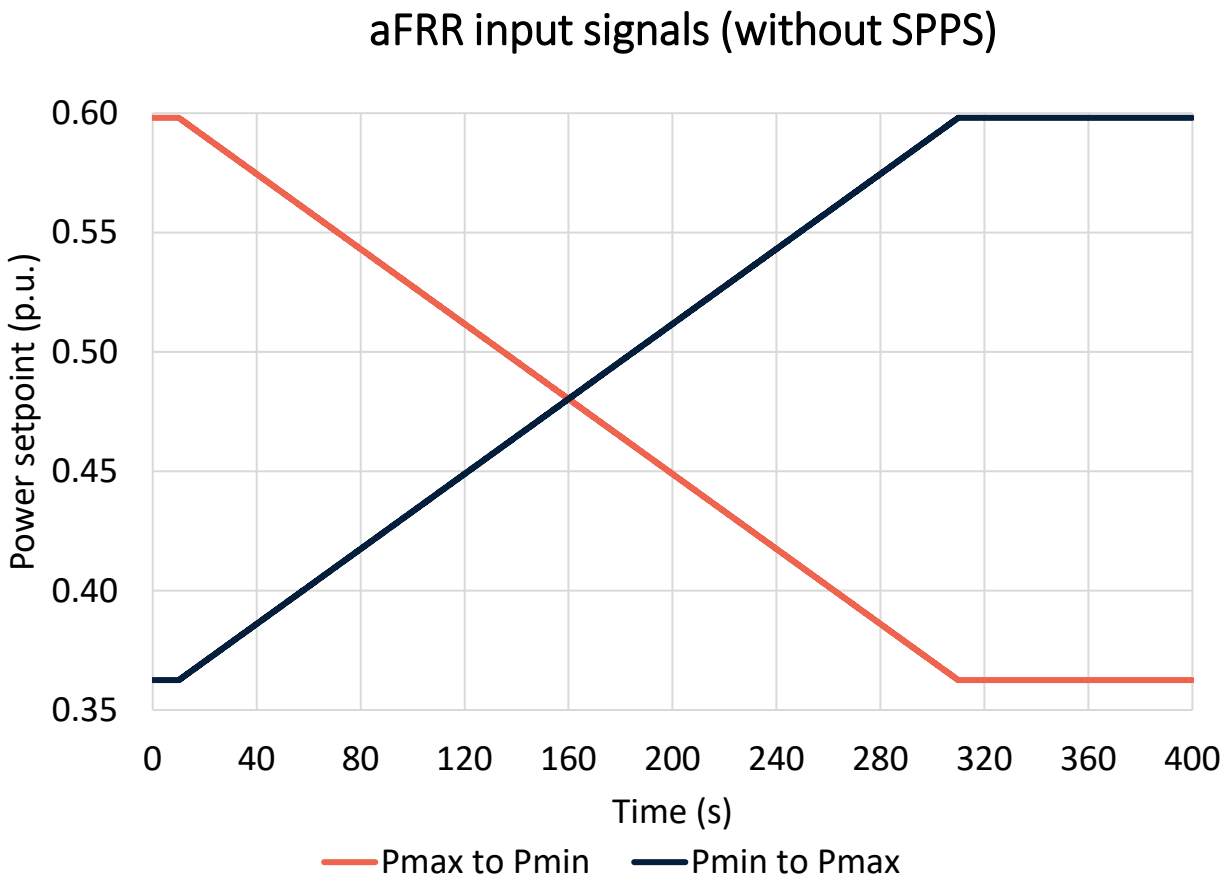
Parameters:

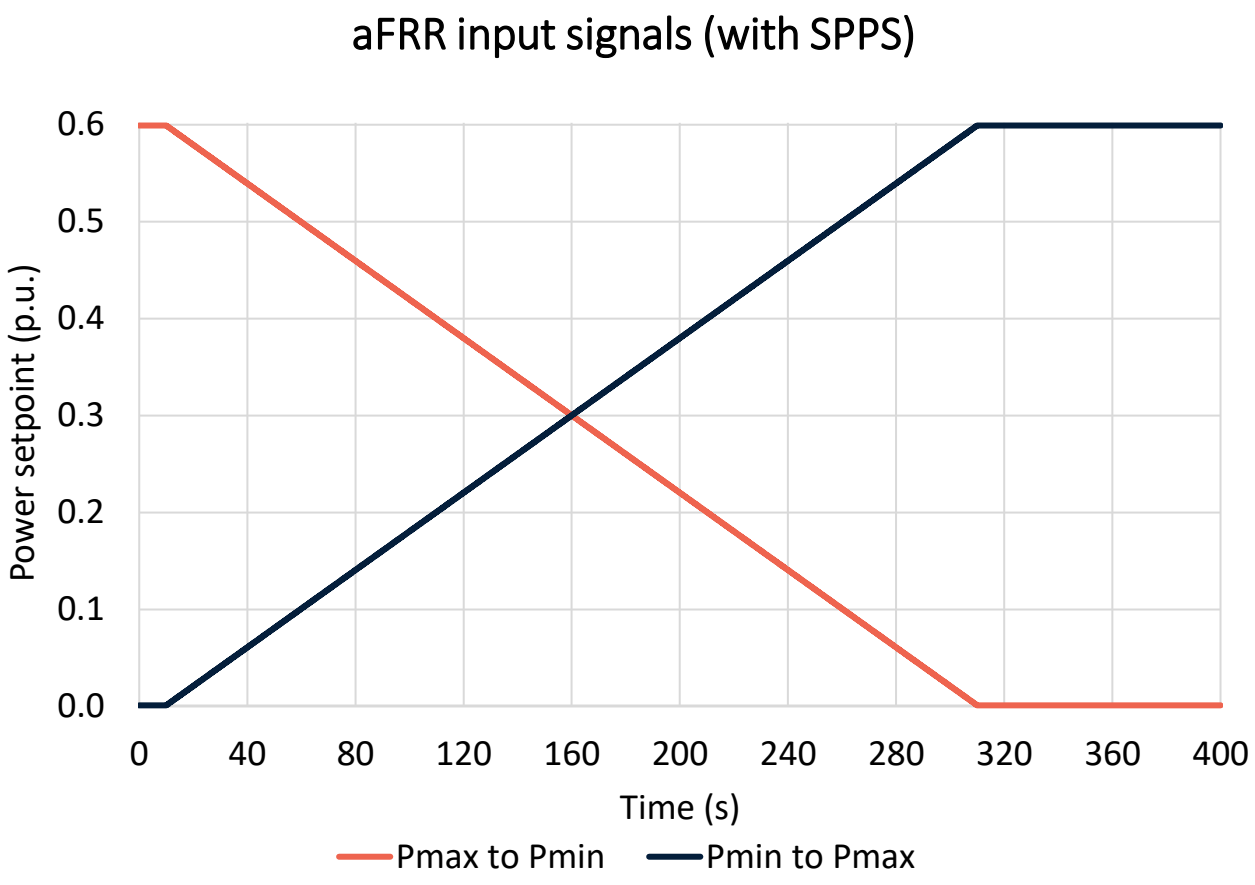
- Rp – permanent droop (p.u.)
- r – transient speed droop (p.u.)
- Tr – governor time constant (s)
- Tp – pilot value time constant (s)
- Tg – gate servomotor time constant (s)
- VELM – gate velocity limit (p.u./s)
- Tw – water starting time constant (s)
- a11, a13, a21 and a23 – penstock coefficients
- Gmax – maximum gate opening (p.u.)
- Gmin – minimum gate opening (p.u.)

Alqueva – Fixed speed model (with and without SPPS)

aFRR input signals

Turbine mode



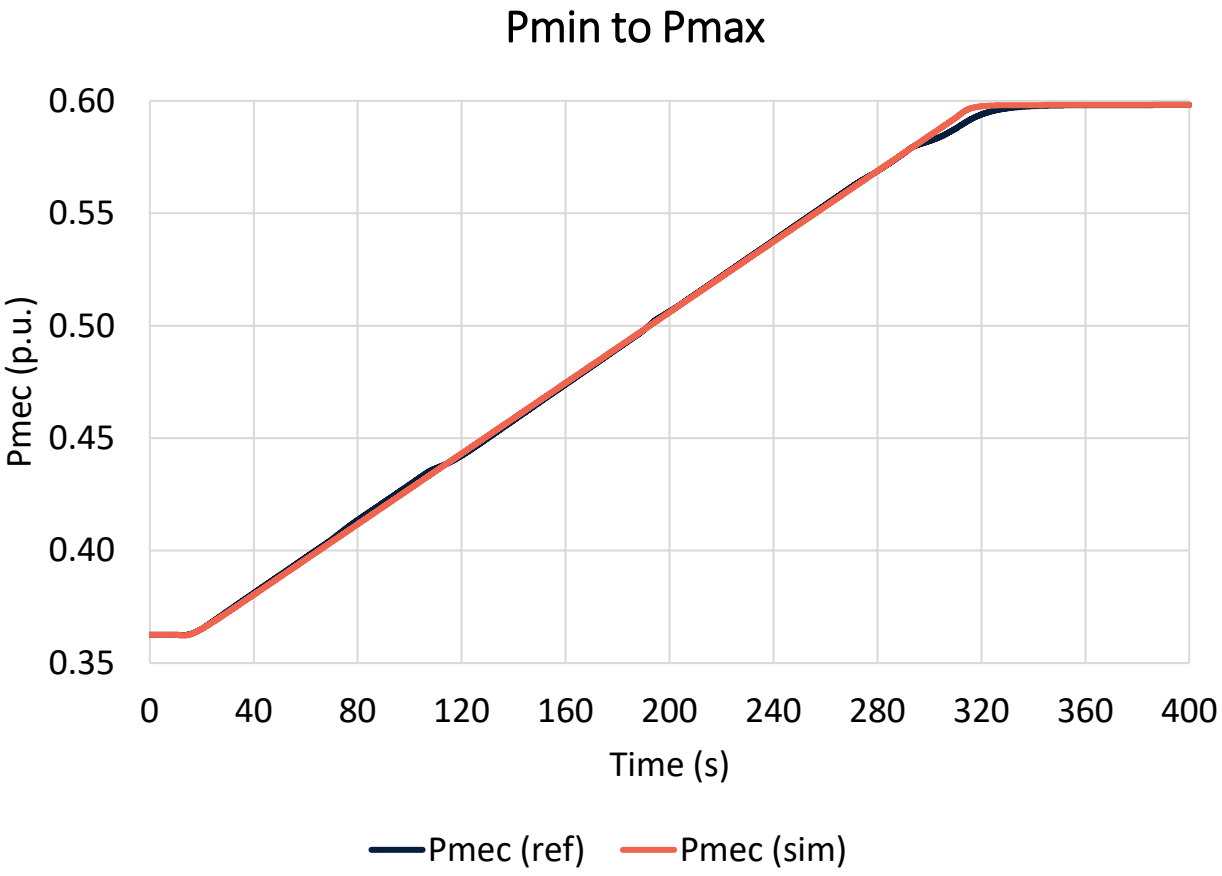


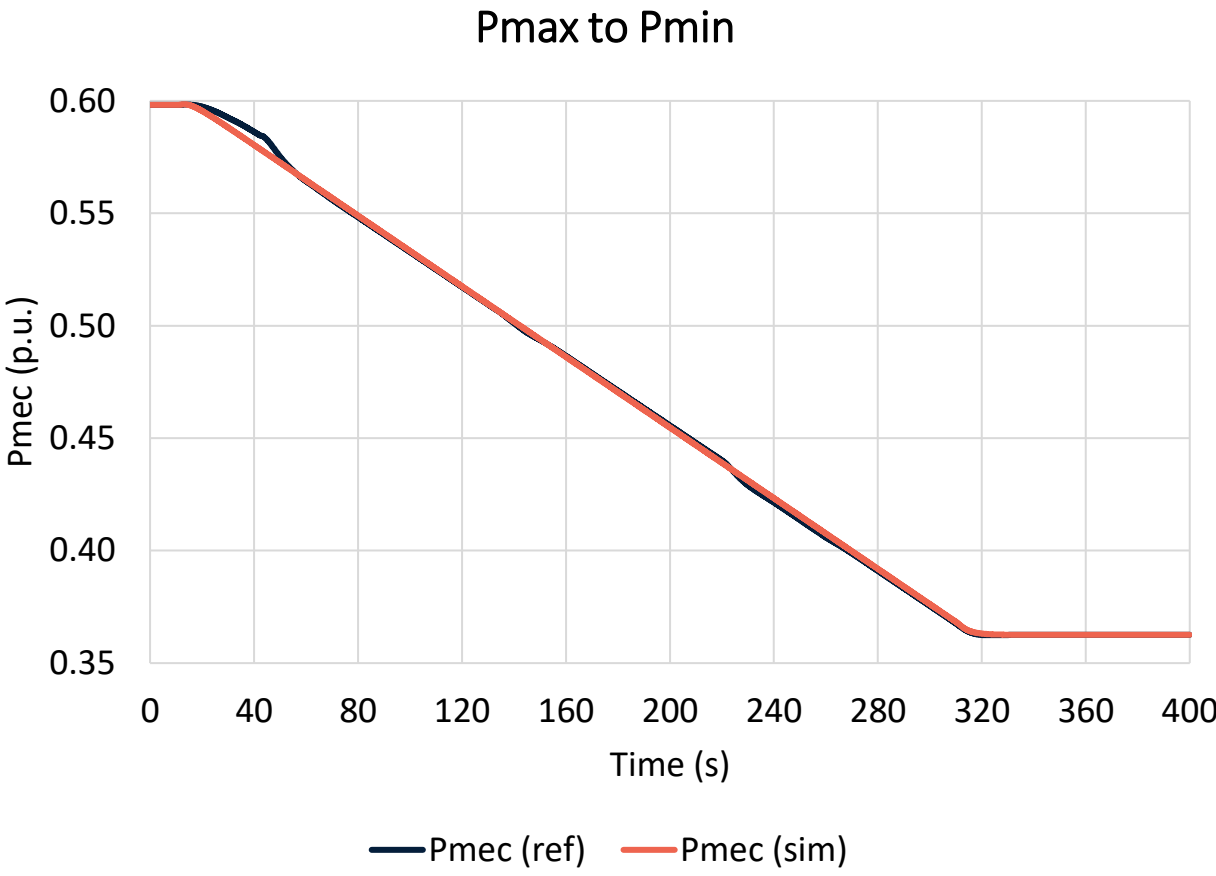
Pump mode: no capability to comply with service requirements

Alqueva – Fixed speed model without SPPS

aFRR service provision

Turbine mode

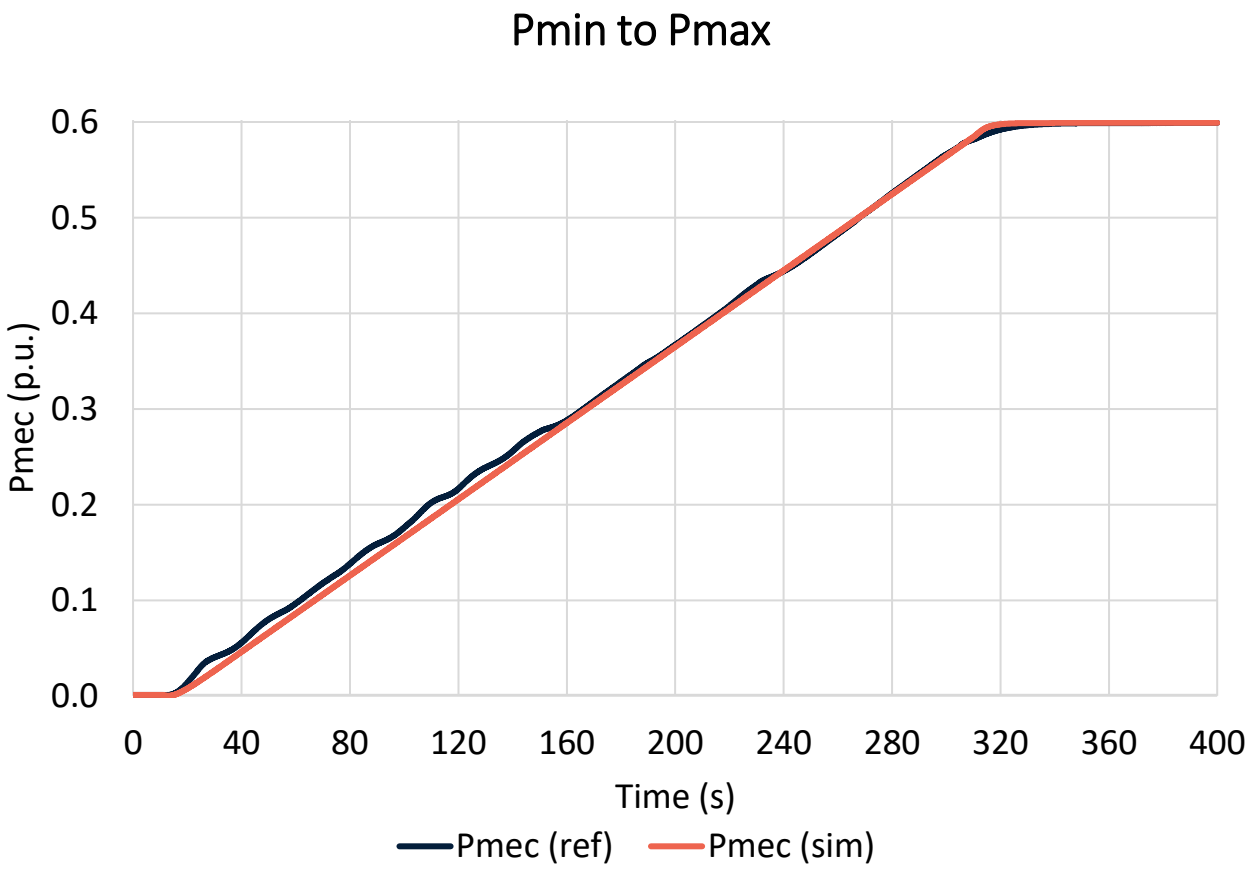


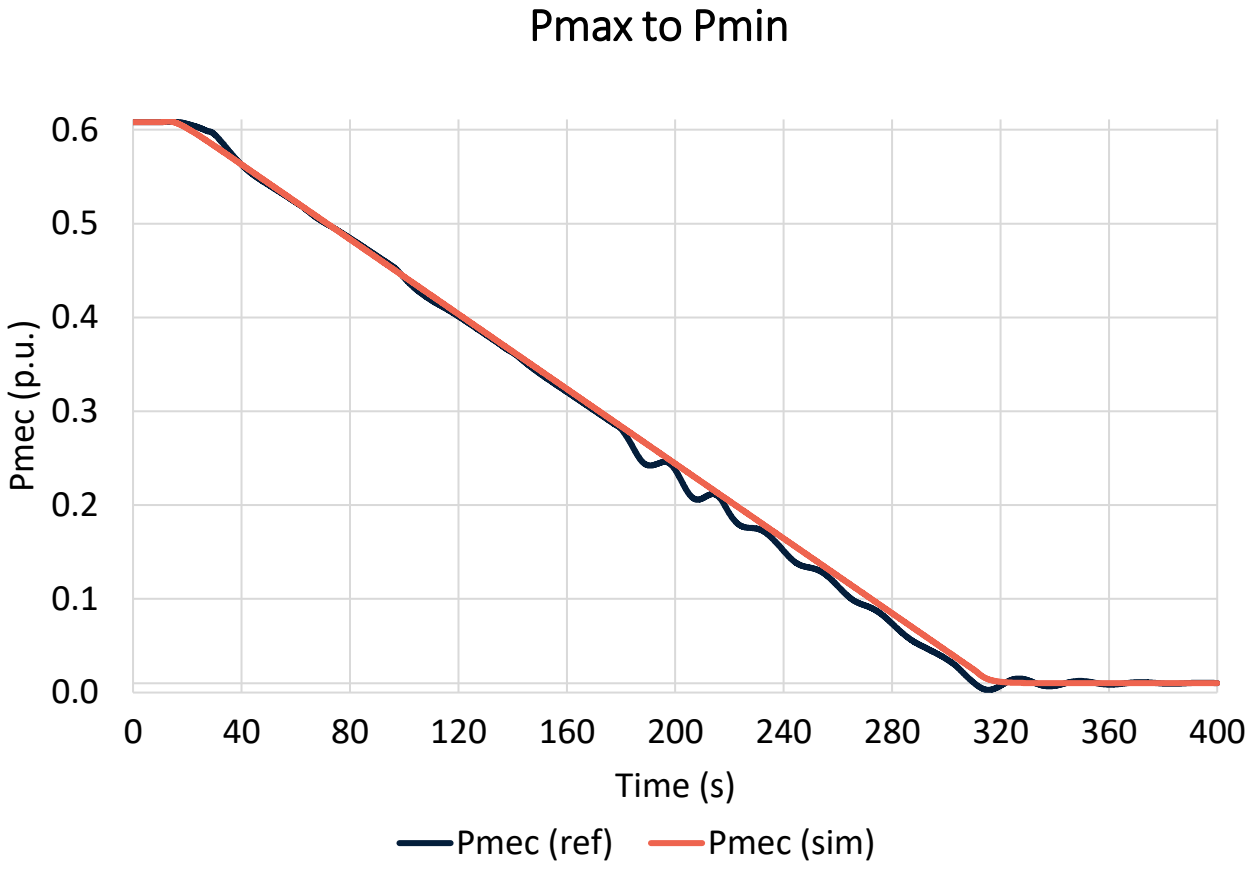


Alqueva – Fixed speed model with SPPS

aFRR service provision

Turbine mode





Alqueva – Fixed speed model (with and without SPPS)
aFRR service provision

Pump mode

No capability to comply with service requirements