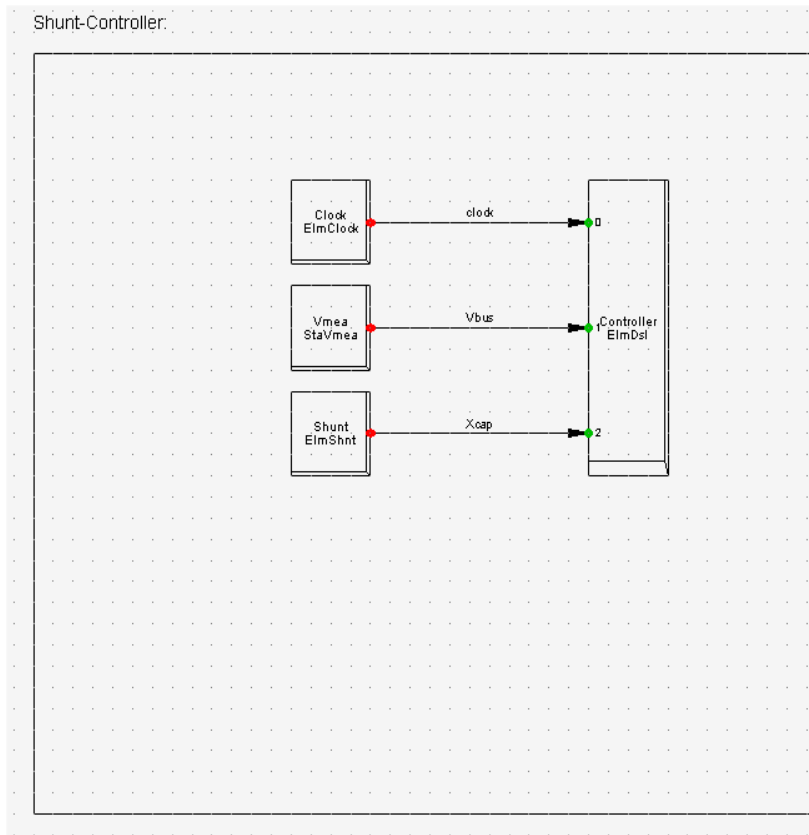


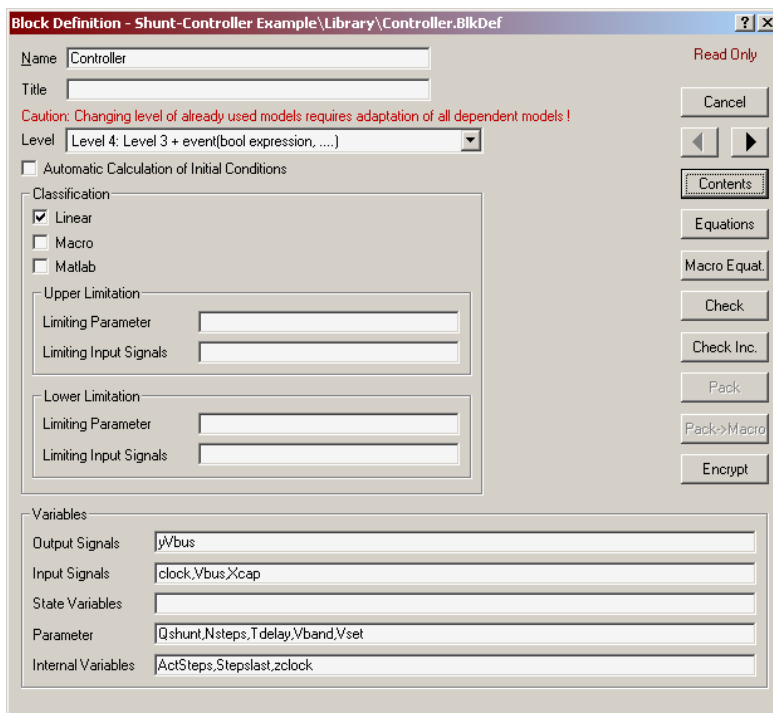
Example of a simple shunt controller:

Block Diagramm:

=====



Parameter, input and output signals definitions:



Block Definition - Shunt-Controller Example\Library\Controller.BlkDef

Name: Controller

Title:

Caution: Changing level of already used models requires adaptation of all dependent models !

Level: Level 4: Level 3 + event(bool expression,)

☐ Automatic Calculation of Initial Conditions

Classification:

- ☒ Linear
- ☐ Macro
- ☐ Matlab

Upper Limitation:

Limiting Parameter:

Limiting Input Signals:

Lower Limitation:

Limiting Parameter:

Limiting Input Signals:

Variables:

Output Signals: yVbus

Input Signals: clock,Vbus,Xcap

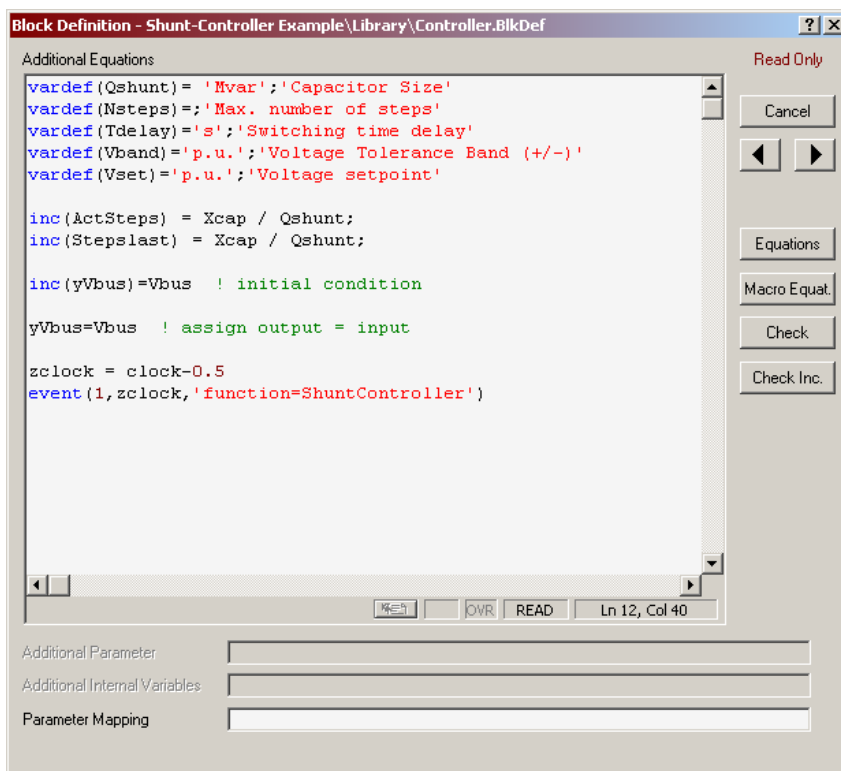
State Variables:

Parameter: Qshunt,Nsteps,Tdelay,Vband,Vset

Internal Variables: ActSteps,Stepslast,zclock

Buttons: Cancel, Contents, Equations, Macro Equat., Check, Check Inc., Pack, Pack->Macro, Encrypt

DSL code, all signals are time continuous signals.



Block Definition - Shunt-Controller Example\Library\Controller.BlkDef

Additional Equations

```
vardef(Qshunt) = 'Mvar'; 'Capacitor Size'
vardef(Nsteps) = 'Max. number of steps'
vardef(Tdelay) = 's'; 'Switching time delay'
vardef(Vband) = 'p.u.'; 'Voltage Tolerance Band (+/-)'
vardef(Vset) = 'p.u.'; 'Voltage setpoint'

inc(ActSteps) = Xcap / Qshunt;
inc(Stepslast) = Xcap / Qshunt;

inc(yVbus)=Vbus ! initial condition

yVbus=Vbus ! assign output = input

zclock = clock-0.5
event(1,zclock,'function=ShuntController')
```

Buttons: Cancel, Equations, Macro Equat., Check, Check Inc.

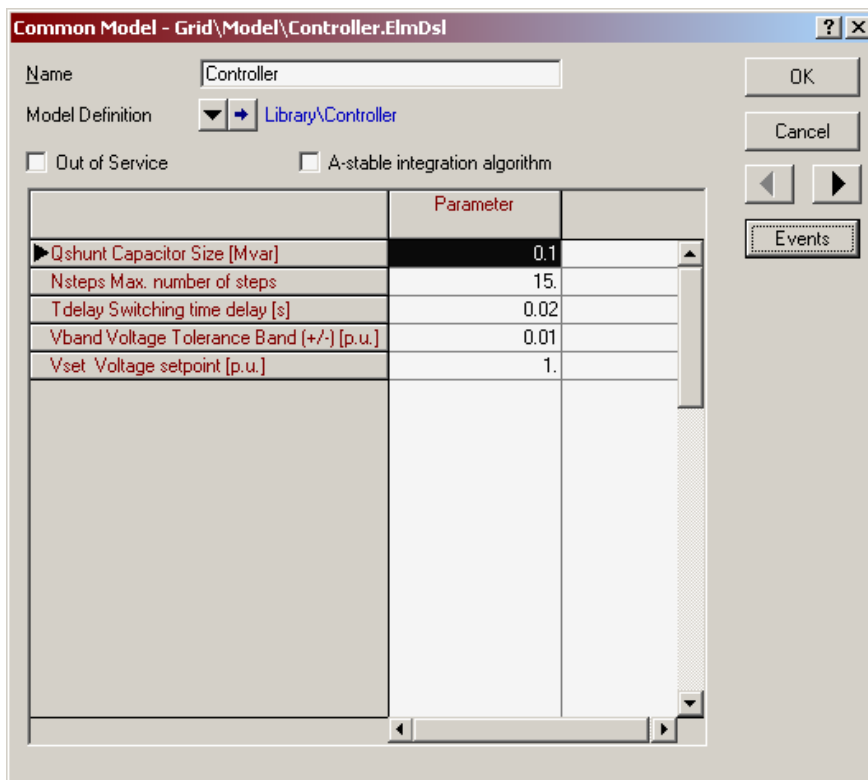
Additional Parameter:

Additional Internal Variables:

Parameter Mapping:

Ln 12, Col 40

Parameter input:



Common Model - Grid\Model\Controller.ElmDsl

Name:

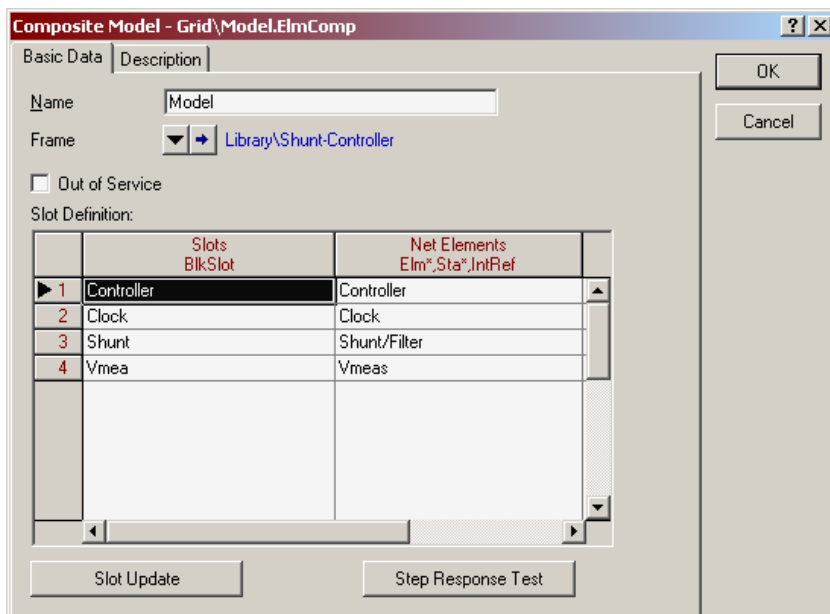
Model Definition: Library\Controller

☐ Out of Service ☐ A-stable integration algorithm

	Parameter
▶ Qshunt Capacitor Size [Mvar]	0.1
Nsteps Max. number of steps	15.
Tdelay Switching time delay [s]	0.02
Vband Voltage Tolerance Band (+/-) [p.u.]	0.01
Vset Voltage setpoint [p.u.]	1.

OK Cancel Events

Composite model:



Composite Model - Grid\Model.ElmComp

Basic Data Description

Name:

Frame: Library\Shunt-Controller

☐ Out of Service

Slot Definition:

	Slots BlkSlot	Net Elements Elm*,Sta*,IntRef
▶ 1	Controller	Controller
2	Clock	Clock
3	Shunt	Shunt/Filter
4	Vmea	Vmeas

Slot Update Step Response Test

OK Cancel

User defined c function in digexdyn.dll:

```
void __cdecl ShuntController(double tEvent,double** dParams,const double** dOuts,const double**
dIntSigs,char** eventstr,char* msg,int nParams,int nOuts,int nIntSigs)
{
    double *actSteps,*Stepslast;
    double Tdelay,Vbus,Qshunt,Vband,Vset;
    int Nsteps;

    actSteps = dParams[0];
    Nsteps = ROUND(*(dParams[1]));
    Qshunt = *(dParams[2]);
    Stepslast = dParams[3];
    Tdelay = *(dParams[4]);
    Vband = *(dParams[5]);
    Vset = *(dParams[6]);

    Vbus = *(dOuts[0]); // voltage at bus

    if (Vbus < (Vset-Vband)) { // step up -> increase tap nstep
        if ( (*actSteps)+1 < Nsteps) {
            (*actSteps) = (*actSteps) + 1;
        }
        else {
            sprintf(msg,"Could not increase capacitor. Max. steps reached.");
        }
    }
    else if (Vbus > (Vset+Vband)) { // step down -> decrease tap step
        if ( (*actSteps)-1 >= 0) {
            (*actSteps) = (*actSteps) - 1;
        }
        else {
            sprintf(msg,"Could not decrease capacitor. Min. steps reached.");
        }
    }

    if (fabs((*actSteps) - (*Stepslast)) > 0.1) { // no. of steps changed => set event
        int newSteps=*actSteps;

        // put output message
        sprintf(msg,"Capacitor changed to Steps=%d",newSteps);

        // generatw tap event for capacitance
        sprintf(eventstr[0],"create=EvtTap target=Shunt name=QshuntStep dtime=%f i_tap=2 ntap=%d",
            Tdelay,newSteps);
    }

    *Stepslast = *actSteps; // store new step as old step
}
```