

Sensitivity analysis 3: Obtain the bounds of prestretch values to use in the calibration

Methods

- Used as a last check on model convergence and to obtain the prestretch value bounds to use in the calibrations.
- This sensitivity analysis was run for all eight models
- Timesteps:
 1. 0 - 0.1 Apply prestretch
 2. 0.1 - 0.5 Apply axial load (-20N) Only for oks models
 3. 0.5 - 1.5 Apply load of interest
- Simulations:
 - Eight Python scripts were run:
 - 2 times AP: ACL & PCL
 - 4 times IE: ACL, PCL, MCL & LCL
 - 2 times VV: MCL & LCL
 - Four separate simulations with different applied loads per script
 - AP simulations: -50 N, 50 N, -100 N, 100 N
 - IE simulations: -2000 Nmm, 2000 Nmm, -4000 Nmm, 4000 Nmm
 - VV simulations: -4000 Nmm, 4000 Nmm, -8000 Nmm, 8000 Nmm
- Prestretch values
 - One ligament prestretch value changed at the time, where the other three ligament prestretch values were set to 1.0.
 - ACL: 0.75 - 1.0 (in steps of 0.01)
 - PCL: 0.95 - 1.2 (in steps of 0.01)
 - MCL: 0.95 - 1.2 (in steps of 0.01)
 - LCL: 0.85 - 1.1 (in steps of 0.01)
- Look at convergence

Results

Full results can be found in: *Sensitivity analysis 3 results.pptx*

Table: Sensitivity study 3 results, indicating which prestretch values resulted in converging simulations (Ex. = excluding prestretch values in the middle).

	ACL AP	ACL IE	PCL AP	PCL IE	MCL IE	MCL VV	LCL IE	LCL VV
Oks001	>0.95	>0.95	>0.9	>0.9	>0.96	>0.96	<1.09	<1.09
Oks002	<1.06 ex. few	<1.04 most have trouble	<1.06 but all not great ex. 2	<1.06 >0.92 but all not great	Almost none best in lower PS	<1.04 but all not great.	None	None, some almost
Oks003	All	0.9-0.96	0.9-0.98	All	All ex. 2	All ex. 2	All ex. 2	All ex. 2

Oks004	>0.91	>0.91	<1.09 ex. 1	<1.09 ex. 1	>0.95<1.07	>0.95<1.07	>0.95<1.08 ex. 2	>0.95<1.08 ex. 2
Oks006	Not great	Not great	Not great	Not great	Not great	Not great	Bad	Bad
Oks007	Mixed	>0.93 <1.06	>0.91<1.05	>0.91<1.05 ex. some	>0.95<1.09 ex. A lot	>0.95<1.09 ex. some	>0.95<1.04 ex. A few	>0.95<1.04 ex. A few
Oks008	>0.9	>0.9	All ex. 1	All ex. 1	All	All	All	All
Du02	All	All	All	All	All	<1.06	All ex. 1	>0.95

Conclusion

- The simulations of the oks002, oks006 and oks007 models were stopped manually because they took very long.
- We found difficulties with models oks002, oks006 and oks007, however, we chose to run the calibrations with the models as they are to see how well we can get them to work by calibrating their prestretch values.