dynamics, with a time constant of around 15 s, present in the measurements. These additional dynamics could come from the dynamics of the temperature sensor. However, the time constant might be somewhat too big to be explained solely by this, therefore further investigation is needed to investigate this phenomenon.

In Figure 6 the measured and modeled output when the sensor dynamics have been included by filtering the output from the model with the time constant of sensor is shown. As can be seen the model seems to agrees well with the measurements.

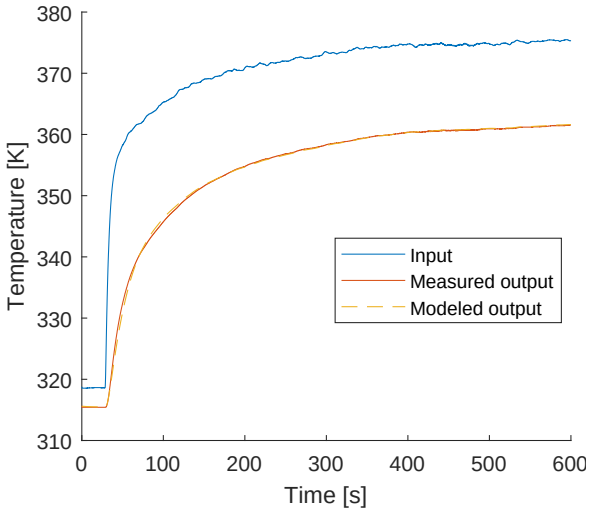

Figure 6. Dynamic measurements from the engine and the output from the model. Here the dynamics of the sensor is included by filtering the output from the model with a time constant of 15 s.

Figure 7 shows the same test as in Figure 6, but now one simulation without the wall temperature dynamics and one without the sensor dynamics is also shown. Here it becomes clear that both these dynamics are needed to capture the dynamics of the system, the sensor dynamics are needed to reduce the initial rate of change and the wall temperature dynamics are needed to capture the slower rate of change towards the stationary level.

6 Conclusions

A dynamic pipe model that combines the adiabatic model of a control volume and that of a stationary one-dimensional flow with heat transfer in a pipe has been developed and validated. The validation has been done using both measurements from an engine in a test stand as well as simulations from a detailed one-dimensional model. The model has shown to agree well with the measurements from the engine and the simulations from the one-dimensional model.

6.1 Future Work

Interesting future work would be to try to separate temperature changes in the inlet temperature from changes in

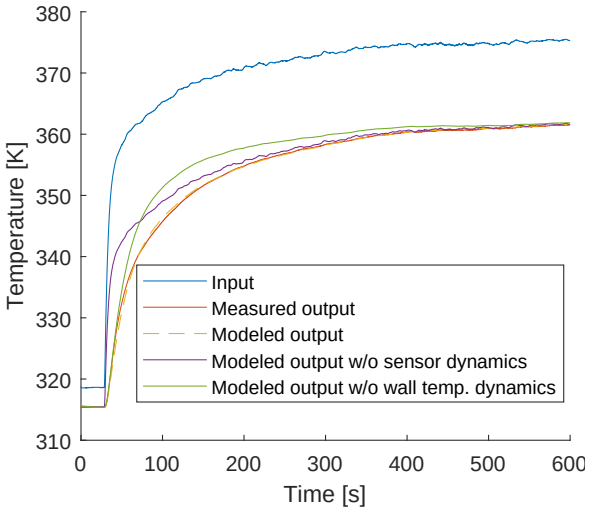

Figure 7. Dynamic measurements from the engine and the output from the model. Here the output with and without the sensor dynamics are shown as well as the output when the wall temperature dynamics are removed.

temperature due to compression of the gas, since temperature changes from compression are not affected by the transport delay that changes in inlet temperature are affected by.

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