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Nonlinear Identification of the Suction Manifold of a Supermarket Refrigeration System using Wavelet Networks

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INTRODUCTION & AIM

➢Commercial Cold Storage System

- Energy intensive thermal systems
- Stores products within desired temperature bounds

➢Suction Manifold

- Supplies refrigerant from the evaporator outlet to the compressor rack
- It is highly nonlinear and a key refrigeration subsystem
- Data-driven approach is needed to model such a system

Figure 1: Cold Storage **Room**

METHOD

➢Nonlinear ARX Modeling

- Consists of model regressors and output functions
- Regressors are assigned to output functions
- Wavelet Networks is selected as output function
- Model estimation is done with simulation focus
- Model output is compared with the estimation data set
- Choose the best model that accurately describes the dynamics

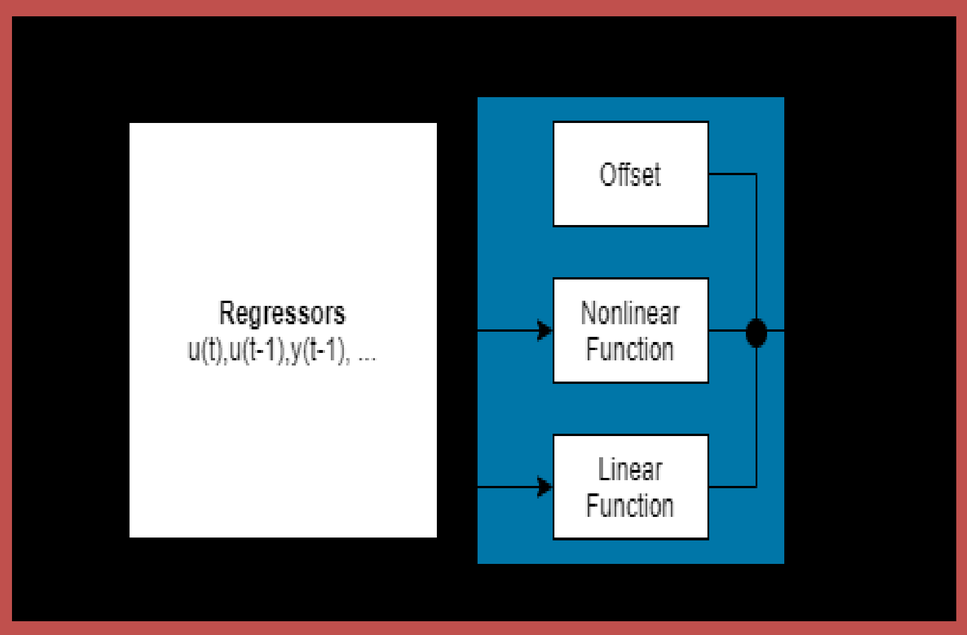

Figure 2: Structure of Single-Output Nonlinear ARX Model

RESULTS & DISCUSSION

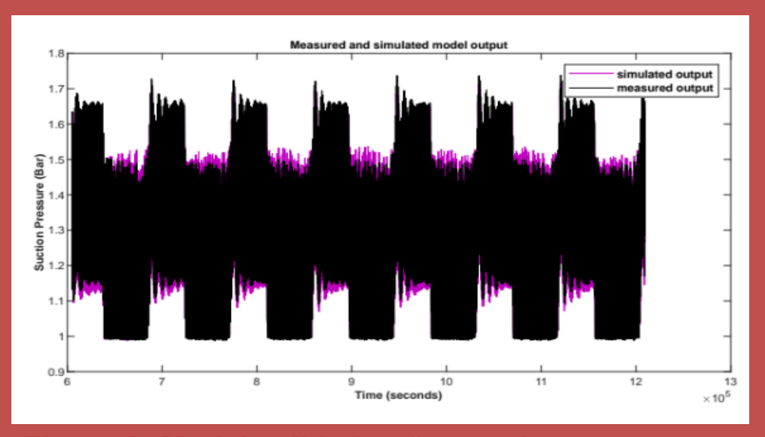

Figure 3: Model validation for suction pressure

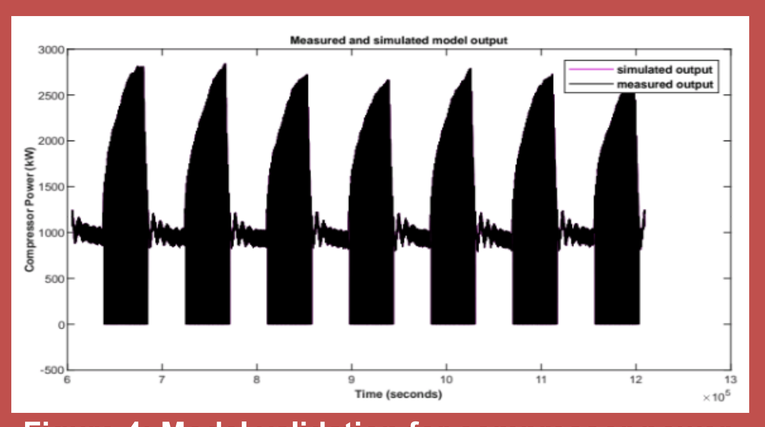

Figure 4: Model validation for compressor power

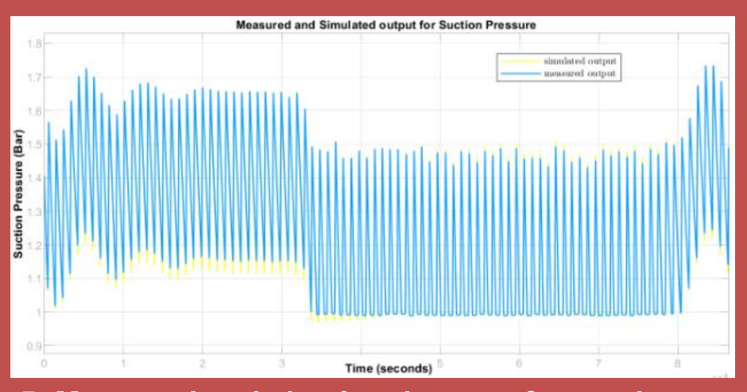

Figure 5: Measured and simulated output for suction pressure

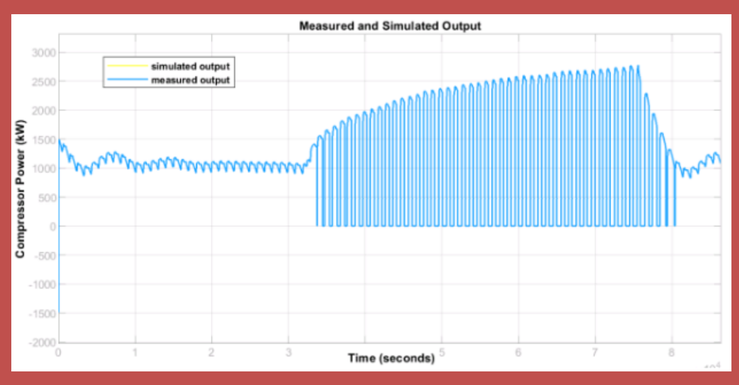

Figure 6: Measured and simulated output for compressor power

CONCLUSION

The nonlinear data-driven identified model of the suction manifold developed was stable and robust, and could handle strong nonlinearities.

FUTURE WORK / REFERENCES

Future work will focus on designing nonlinear model predictive controller to control the developed data-driven model