

Take Home Test

Rahul Subramanian

December 9, 2020

1 Question

1. Assess yourself, from 1 to 4, in the following areas or skills. We are not looking for a candidate to have experience with all, or even a majority, of these areas. This question is much less about the magnitude of the numbers and more about their relation – where do you think your strengths are?

1 = Very little or no experience

2 = Some experience, but not yet at a level of full competence and confidence

3 = A lot of experience, generally able to do this work at a professional level

4 = Very experienced, typically the expert on my team or among peers

- PID control
- Model predictive control
- Optimal control methodologies
- Dynamic systems modeling
- Microcontrollers
- Scripting languages
- C/C++
- Software version control
- Experimental design
- Instrumentation
- Data acquisition (NI or other DAQ)
- Project management
- Written communication
- Presentation
- Heat transfer
- Thermodynamics
- Fluid mechanics

Answer

Skill	Level	Description	Support
PID Control	4	—	—
Model Predictive Control	2	—	I need to put in the time on this one, external support not required.
Optimal Control	2	I need to learn more about dynamic programming for dynamic optimization. But I do kalman filters and LQR	—
Dynamic systems modeling	4	ODEs are friendly, PDEs are within reach	A thermal science expert, to bake what they know into the dynamics
Microcontrollers	3	—	Firmware engineer to own OS/drivers
Scripting languages	4	Matlab	—
C/C++	2	—	Firmware engineer to fill the gap, though I can (and desperately want to) come up to speed with this. Expect me to become useful on this within a quarter or two or joining. I have in the past done all my work including real-time code in Simulink
Software version control	2	I use it regularly	Git Wrangler
Experimental Design	1	I just googled this	—
Instrumentation	2	It's the systems/test engineer that has handled this in my experience, but I can do this. Related skill - I generally pick sensors and decide (with electrical engineer) interfacing with the micro.	I will need to read the manual on thermocouples, anemometers, etc
Data acquisition (NI or other DAQ)	2	Same answer as 'Instrumentation'	—

Project management	3	Part of my responsibility is to scope out my work. As I have spent time in thermal teams, there's no one to guide me on this.	—
Written communication	3	I hope you like this document.	—
Presentation	3	—	—
Heat transfer	3	I have a working knowledge of heat transfer. I don't calculate convective heat transfer coefficients or design HXs. But if I know the U value as a function of inner/outer mdots, I can create a simulation no problem.	Thermal Engineer
Thermodynamics	3	By example - I am very comfortable with P-h diagrams, and we should add mdot as a 3rd dimension to contemplate operating points for a constant evaporator power flux to make it complete. I cannot derive the equation of work done for polytropic compression, though I find that equation quite useful for the compressor	Thermal Engineer
Fluid mechanics	2	—	Thermal Engineer