Comments for Collins:

Dear Collins,

Thank you for the opportunity to read your thesis! It’s a strong body of work, very well-written, and a pleasure to read. I’d like to offer a few comments on each chapter, though of course, if my recommendations conflict with Prof. Hudgings’, you should follow her advice instead!

Ch. 1:

-You used a few terms in the latter sections (1.3-1.5) that would have benefitted from a brief definition for a non-expert, for example, “chirped photonic crystals” and “convection shields.”

-I think you missed a small opportunity to re-focus your reader at the end of section 1.3. After the list of PDRC types, you could explicitly state which type(s) you are concerned with in this thesis so the reader knows what to expect looking ahead.

Ch. 2:

I thought the theoretical review in this chapter was phenomenal. It’s very clear, detailed, and complete, and every time I began to think, “Yes, but what about [this important concept]?” you addressed that concept in the very next section. With that as background, I have a few small comments to hone this already very strong chapter. The goal of these recommendations is primarily to help guide your reader’s attention through the dense theoretical structure of the chapter.

-In a chapter so wide-ranging, an initial outline, or a small reminder between sections, would keep readers focused on your main point.

-Given the importance of the λ dependence of n, I would have appreciated a little more discussion of the physical origin of that dependence.

-Likewise, an explicit mention of the λ dependence of R for dielectric mirrors would have served to re-focus your reader on your overall goal of optimizing R(λ) over a wide visible-IR spectrum.

Ch 3:

The format of this chapter is perfect for training future members of Janice’s lab in how to use COMSOL. However, for a thesis, I’m not sure the COMSOL menu screenshots were the most informative way to present your exploration of the program. I’d recommend focusing on points in the model-building process where a critical physical parameter has to be selected or defined and finding some way (perhaps a flow chart like the first figure in the chapter) to emphasize those decisions in the figures.

-I also missed any results section. You were modeling heat transfer through a metal busbar, and I was surprised not to see any plots of temperature versus time or heat distribution throughout the metal. It seems to me that a feasible final result is necessary to validate the training exercise, regardless of whether this is used as training for future students or not.

-Finally, I’d recommend avoiding the second person in technical writing. You drift into sentences of the structure “You do this,” which makes sense in a protocol, but discursive technical writing favors first or third person.

Ch. 4:

I appreciated Janice’s comment on a different thesis that “no good deed goes unpunished” with regard to theses: because you presented your results so clearly, I have many follow-up questions!

-First, there is a small issue on pg. 54, where you have left a few paragraphs unfinished. I’d recommend completing those before sending your thesis off to be printed. I also found the switch between numerical and alphabetical indexing (1-3 vs a-c) in section 4.1.2 mildly confusing.

-I missed a clear justification in some parts of this chapter for why you made the modeling decisions you made.

-For example, after the discussion of angle of incidence in the theoretical chapter, I wondered why you didn’t vary the angle of incidence in Figures 4.4 and following. At minimum, I’d recommend stating the angle of incidence you chose to model; I could not find that in the discussion, though it’s possible I missed it.

-Similarly, I wonder why you chose to model only the visible range for glass after addressing the NIR range for your anti-reflection coating example, and why you didn’t address the atmospheric window range. I realize that in this thesis, the atmospheric window may have been outside your scope, but in such cases, it remains helpful to explain the choices you’ve made.

-It looks to me like the spectrum in Fig. 4.21 is dominated by the reflectance of the Ag layer. It made me wonder why PDMS was added at all, or whether you modeled the reflectance of the PDMS alone? This result would have benefited from interpretation (perhaps the PDMS is only meant to protect the Ag, for example, and the goal was to show that it minimally impacted the reflectance).

-In the appendix, you advised that a coarse mesh should be used to simulate large volumes with a reasonable amount of processing power. But if you are interested in “phenomena occurring at the nanometer length scale,” wouldn’t it be better to use a finer mesh and sacrifice bulk volume? I missed the justification for why to prioritize one solution over the other.