238 Appendix D

6.1	A visualization of the design process as the selection of an element from the design space \mathcal{D} that is in a region of the output space \mathcal{O} that meets the	
	requirements.	206
6.2	A single design set D , the solution f of its set E of governing equations, and the inverse solution f^{-1} . The local optimal design $d^* = f^{-1}(y^*)$.	210
6.3	Sketch of the extruder design.	212
6.4	The constrained loss function $L(d)$ versus a single adjustable, the thermal resistance R_T .	216
D.2	List of Tables 91	
1.1	Boolean and comparison operators on Boolean and integer inputs x and y	17
1.2	Format specifier terms.	19
1.3	Format specifier types.	20
1.4	Some particularly useful string methods.	20
1.5	Mutability of commonly used built-in types.	22
1.6	Commonly used list methods for a list 1.	23
1.7	Dictionary instance methods for dictionary instance ${\tt d}$ and class method for class ${\tt dict}.$	26
2.1	Python standard library modules of particular interest to the engineer.	42
3.1	JSON to Python reading conversion.	77
3.2	Python to JSON writing conversion.	78
4.1	Elementary mathematical functions in SymPy.	103

Bibliography

Abelson, Hal, and Gerald Jay Sussman. 2016. *Structure and Interpretation of Computer Programs*. 2nd ed. MIT Press (orig. 1996). https://engcom.org/5n.

Carvill, James. 1994. Mechanical Engineer's Data Handbook. Butterworth-Heinemann.

Cross, Nigel. 2021. Engineering Design Methods: Strategies for Product Design, 5th Edition. 5th ed. Wiley. http://gen.lib.rus.ec/book/index.php?md5=988D6046DBEE3E1452E2F099079B445E.

Filik, Ruth, Alexandra Țurcan, Christina Ralph-Nearman, and Alain Pitiot. 2019. "What is the difference between irony and sarcasm? An fMRI study." [in eng]. *Cortex* 115 (June): 112–122. https://doi.org/10.1016/j.cortex.2019.01.025. https://engcom.org/e8.

Gilens, Martin, and Benjamin I. Page. 2014. "Testing Theories of American Politics: Elites, Interest Groups, and Average Citizens." *Perspectives on Politics* 12 (3): 564–581. https://doi.org/10.1017/S1537592714001595.

Gonzalez, Ryan, Philip House, Ivan Levkivskyi, et al. 2024. PEP 526 – Syntax for Variable Annotations, February (orig. 2016). https://engcom.org/9x.

Google. 2024. Google Python Style Guide, February. https://engcom.org/ne.

Harris, Charles R., K. Jarrod Millman, Stéfan J. van der Walt, et al. 2020. "Array Programming with NumPy." *Nature* 585, no. 7825 (September): 357–362. https://doi.org/10.1038/s41586-020-2649-2. https://doi.org/10.1038/s41586-020-2649-2.

Hunt, A., and D. Thomas. 1999. *The Pragmatic Programmer: From Journeyman to Master*. Pearson Education.

Hunter, J. D. 2007. "Matplotlib: A 2D graphics environment." Computing in Science & Engineering 9 (3): 90–95. https://doi.org/10.1109/MCSE.2007.55.

Johnston, Nathaniel, and Dave Greene. 2022. Conway's Game of Life: Mathematics and Construction. Self-published. https://doi.org/10.5281/zenodo.6097284.

Kreyszig, E. 2010. Advanced Engineering Mathematics. 10th ed. John Wiley & Sons.

Langa, Łukasz, and contributors to Black. 2024. Black: The Uncompromising Python Code Formatter, February. https://engcom.org/8n.

NASA. 2002. *NACA High Speed Flight Station "Computer Room"*, June (orig. 1949). https://engcom.org/mz.

NumPy Developers. 2024a. NumPy Reference, February (orig. 2022). https://engcom.org/u5.

NumPy Developers. 2024b. NumPy User Guide, February (orig. 2022). https://engcom.org/5y.

NumPy Developers. 2024c. *NumPy: The Absolute Basics for Beginners,* February (orig. 2022). https://engcom.org/3l.

Python Community. 2024a. Python 3.X Documentation, January. https://engcom.org/n3.

Python Community. 2024b. Python Package Index, January. https://engcom.org/e0.

Python Community. 2024c. Python Packaging User Guide, January. https://engcom.org/w9.

Rossum, Guido van, Jukka Lehtosalo, and Łukasz Langa. 2024. *PEP 484 – Type Hints*, February (orig. 2014). https://engcom.org/z9.

Rossum, Guido van, Barry Warsaw, and Alyssa Coghlan. 2024. PEP 8 – Style Guide for Python Code, February (orig. 2001). https://engcom.org/3z.

SymPy Development Team. 2023a. *Advanced Expression Manipulation*, May. https://engcom.org/95.

SymPy Development Team. 2023b. *Core* [SymPy Documentation], May. https://engcom.org/92. SymPy Development Team. 2023c. Simplification, May. https://engcom.org/14.

SymPy Development Team. 2023d. Writing Custom Functions, May. https://engcom.org/3c.

Tufte, Edward R. 2001. The Visual Display of Quantitative Information. 2nd ed. Graphics Press.

Yasskin, Jeffrey. 2024. *PEP 3141 – A Type Hierarchy for Numbers*, February (orig. 2007). https://engcom.org/41.

Contributors

Associate Professor Rico A. R. Picone Department of Mechanical Engineering Saint Martin's University Lacey, Washington, USA