



1001 Things to Know About Temperature Control - BBB (Borrow)

Advanced Temperature Control by Gregory McMillan

Reviewed by Nick Sands

Take 800 pages of detailed advice on temperature control based on years of practical experience and compress it into 160 pages to get *Advanced Temperature Control*, by Greg McMillan. McMillan is an ISA fellow, a former "Control Engineer of the Year", one of the first inductees in to the "Process Control Hall of Fame", an affiliate professor at Washington University in St. Louis, and because he shares his 33 years of experience at Monsanto and Solutia, one of ISA's most prolific authors. There is no doubt that McMillan knows his stuff, but it can be challenging to follow in this compressed format (which may be the structure of ISA's ILM series). The title is apt: this is no introduction to temperature control. There are no basics in this book, but rather the details that even experienced engineers may not know.

The book starts with a few opening words and dives into a very detailed discussion on measurement error. McMillan gives the explanations and equations for errors due to conduction, radiation, dynamics, process velocity, sensor, nonlinearity, decalibration, insulation, and leadwires. After reading the details on all these errors it's hard to trust any temperature reading.

After measurement, the focus shifts to control. Practical open and close loop tuning methods are covered. Because controller gains are rate dependent in many temperature loops, there can be significant benefits from the application of auto-tuners or fuzzy logic controllers. A key message is that almost all temperature control loops are tuned with excess reset and insufficient gain and derivative. Further analysis provides general relationships of tuning constants to process dynamics. The benefits of standard control strategies such as cascade control and ratio control are evaluated against the challenges of temperature loops. There is also a brief section on model based temperature control.

The second half of the book examines temperature control for specific process equipment, albeit in a general cases. This is where the brevity of the book can mean the reader is left to work out the missing steps in the discussions. On exchanger control there are suggestions on stability and design as well as the impact of typical strategies on dynamics. The chapter on reactors deals mainly with jacketed CSTRs, highlighting the need for cascade control and considerations for split range controllers. Distillation column temperature control, a topic that fills volumes, is covered in one condensed chapter. There is only room for general advice and considerations. But the final chapter on all other process equipment is even more compressed. Seven different processes are mentioned in one paragraph.

While any book by Greg McMillan is worth reading and a good addition to a control library, this book is not at the top of the list. There are equations that allow a control engineer to quickly assess errors and exchanger performance capability and a collection of temperature control tips and facts like no other. It can be a challenge to understand or even accept all of the statements since in this brief format there is not room to develop or prove some concepts, only to list them. There are several appendices that further develop the equations and a thorough set of exercise questions. *Advanced Temperature Control*, available from ISA for \$45 (member price), is worth reading and rated a borrow (BBB).