Demo — Process Control Assistant

How NOVA-AI turns engineering textbooks into a sourced Q&A assistant

2026-07-10

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Data source

- **Source:** engineering textbooks (uploaded PDFs), not a website:
  - King — *Process Control: A Practical Approach* (2011)
  - Seborg & Edgar — *Process Dynamics and Control*
  - Kravaris & Kookos — *Understanding Process Dynamics and Control*
- **Added:** 2026-07-10, by dropping the PDFs into a folder.
- **Coverage:** 3 textbooks indexed. (A fourth title was a scanned, image-only PDF with no selectable text, so it was skipped — it would require OCR to include.)
- **Hosting:** all processing and storage is local — the documents never leave the machine.

How the agent was created

1. **Upload** — the PDFs were placed in a folder.
2. **Read** — each PDF was read page by page (born-digital text extraction).
3. **Split** — each page's text was broken into short passages, each tagged with its page number.

4. **Embed** — each passage was converted into a semantic vector using a local model (`sentence-transformers`, `all-MiniLM-L6-v2`), producing **6,896 passages** across the three books.
5. **Index** — the vectors and passages were saved as the `process-control` agent.

Work process

1. You ask a question in plain English.
2. The agent finds the passages whose meaning is closest to your question (semantic search), plus their neighbouring passages so a table or figure follows its heading.
3. Claude composes a clear answer **using only those passages** and cites the exact **book and page**.
4. Each cited source can be opened at its page, and the whole answer can be saved as a document (`.qmd` / HTML / PDF).

Sample questions

1. How do you tune a PID controller?

Answer (ask the agent, then paste the cited answer here):

> **Note**
>
> Based on the available documents, here's what I can tell you about tuning a PID controller:
> **General approaches:** - Many engineers tune PID controllers by trial-and-error, but this is time-consuming and rarely yields optimal performance. The book argues that most published tuning methods have serious limitations [S1]. - Model-based design and tuning methods are recommended because they provide insight and usually have only a single adjustable parameter — but they require a reasonably accurate process model. After installation, on-line tuning is commonly used to improve key control loops [S4]. - Tuning inevitably requires tradeoffs between performance objectives [S4].
> **The three actions and their parameters:** - **Proportional (Kc):** The optimum controller gain must be adjusted as other actions are added. Optimum performance is a trade-off between proportional and integral action [S2]. - **Integral (Ti):** The integral (reset) time is the time taken to "repeat" the proportional action. Note that units vary between systems (minutes, hours, seconds, or repeats per minute). In the book's convention, higher Ti gives *less* integral action. Even a small amount of integral action eliminates offset [S10][S11]. Adding integral action to a P-only controller means the optimum Kc must be substantially reduced [S2][S13]. - **Derivative (Td):** Derivative time dictates how much derivative action is taken; it changes the output in proportion to the

rate of change of error, acting in an anticipatory manner [S12][S13]. Derivative action should be *increased* as the / ratio increases [S16].
Practical notes on choosing between PI and PID: - For most situations a PI controller is adequate, and many engineers omit derivative action to simplify trial-and-error tuning — a two-dimensional search is easier than a three-dimensional one [S2]. - However, adding derivative action can substantially improve even an optimally tuned PI controller, particularly by preventing excessive overshoot [S12][S15]. - Different tuning of the proportional and integral actions is required when derivative action is added to an optimally tuned PI controller [S15]. - One tuning objective described is to minimize ITAE subject to a maximum MV (manipulated variable) overshoot of, e.g., 15% on a self-regulating process [S5][S15].
The sources describe principles and tradeoffs rather than a single step-by-step numerical procedure, so I can't give you exact tuning formulas from these excerpts.

Sources:

Note

- [**S1**] King-2011-process-control-a-practical-approach-2ed.pdf · p.11
- [**S2**] King-2011-process-control-a-practical-approach-2ed.pdf · p.60
- [**S3**] King-2011-process-control-a-practical-approach-2ed.pdf · p.109
- [**S4**] process-dynamics-and-control-dale-e.-seborg-thomas-f.-edgar-etc.-z-lib.org_.pdf · p.236
- [**S5**] King-2011-process-control-a-practical-approach-2ed.pdf · p.110
- [**S6**] King-2011-process-control-a-practical-approach-2ed.pdf · p.11
- [**S7**] King-2011-process-control-a-practical-approach-2ed.pdf · p.11
- [**S8**] King-2011-process-control-a-practical-approach-2ed.pdf · p.11
- [**S9**] King-2011-process-control-a-practical-approach-2ed.pdf · p.12
- [**S10**] King-2011-process-control-a-practical-approach-2ed.pdf · p.59
- [**S11**] King-2011-process-control-a-practical-approach-2ed.pdf · p.59
- [**S12**] King-2011-process-control-a-practical-approach-2ed.pdf · p.60
- [**S13**] King-2011-process-control-a-practical-approach-2ed.pdf · p.60
- [**S14**] King-2011-process-control-a-practical-approach-2ed.pdf · p.108
- [**S15**] King-2011-process-control-a-practical-approach-2ed.pdf · p.109
- [**S16**] King-2011-process-control-a-practical-approach-2ed.pdf · p.110

2. What is cascade control used for?

Answer (ask the agent, then paste the cited answer here):

Note

Cascade control is used to improve disturbance rejection through an inner (secondary) feedback loop that reduces the effect of a significant disturbance before it affects the controlled output [S1][S12]. It involves two feedback loops, one inside the other, where the outer (primary) loop provides the set point of the inner (secondary) loop [S9].
It is most commonly used when a flowrate needs to be manipulated but is disturbed by upstream or downstream pressure variations [S1][S8][S10]. For example, in a liquid-level control system, an inner flow control loop ensures the proper flowrate is delivered despite upstream pressure changes, while the outer level controller sets the desired flowrate [S3][S11][S13]. The inner loop reacts to the disturbance before its effect becomes visible to the important controlled variables, reducing or even eliminating its impact [S12].

Sources:

Note

- **[S1]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.736
- **[S2]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.707
- **[S3]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.359
- **[S4]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.710
- **[S5]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.722
- **[S6]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.735
- **[S7]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.736
- **[S8]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.736
- **[S9]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.737
- **[S10]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.706
- **[S11]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.706
- **[S12]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.707
- **[S13]** understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-

kookos-z-lib.org_.pdf · p.707

- [**S14**] understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.359
- [**S15**] understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.359
- [**S16**] understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.359
- [**S17**] understanding-process-dynamics-and-control-costas-kravaris-ioannis-k.-kookos-z-lib.org_.pdf · p.360