Hustrulid Technologies · Software · Education · Consulting

ONSITE TRAINING · FOUR DAYS · AT YOUR FACILITY

Pulley Engineering and Design

Shaft, shell, end disk, locking assembly — the engineering of a conveyor pulley from first principles to the shop floor, taught to your team at your facility, on your own pulleys.

Photo: pulleymaven.com

Why this course exists

A conveyor pulley carries the full belt tension every revolution, for years, and when it fails it takes the belt with it. Yet nobody teaches how to design one. The shaft has standards and the welds have codes; CEMA says what a pulley must survive but not how to build it; and the shell, the end disk, the hub and the locking assembly — and how they share the load between them — live in a handful of papers from 1948, 1963 and 1974, and inside each manufacturer, learned the hard way. **This is the first course devoted to the pulley** — the methods, the standards that agree and the ones that don't, the failures — so your team can design one, defend the calculation, and read a competitor's.

Who it is for

Pulley manufacturers
Engineering teams who size shafts, shells, end disks and locking assemblies every week and want the reasoning behind the numbers — including the ones the standards disagree on.

Companies entering pulley manufacturing
Moving from stock pulleys into engineered class, and needing design capability, a cost model, and a product structure from the first quotation.

End users who depend on pulleys
Mines, ports, and plants — the people who write the specification, review the vendor's calculation, and answer for the failure.

What your team leaves with

- **The shaft, three ways.** Size it to AS 1403, ANSI B105.1 and ASME B106.1M — and explain why they give different answers, from Mohr's circle to von Mises.
- **The shell, three ways.** Sitzwohl by hand, Lange in closed form, and full FEA — and when each one is enough.
- **FEA done right.** Why most of the pulley FEA pictures in circulation are wrong — how the belt load is applied, how the locking assembly is joined to the shaft, where the model is held, the mesh at the welds — and the checks that prove a model before anyone trusts it: reactions that balance the loads, a shell centre that agrees with Lange.
- **The load-sharing problem.** How the bending moment splits between shaft and end disk, with three stiffness models: Lange/Schmoltzi, the BF Goodrich segmented method for tapered disks, and FEA mode decomposition.
- **Locking assemblies against bending, not just torque.** Clamping force, catalogue de-rating, allowable bending moment, reduced bolt torque, and whether it will slip.
- **The number every standard disagrees on.** The stress concentration factor at the locking assembly — 1.3 in one code, 3.5 in the measurements — and why the catalogue figure is a different quantity altogether.
- **Overhung load, done properly.** The second most common cause of pulley failure, and the one most often left out of the calculation.
- **Lagging and drive slip.** Rubber and ceramic lagging, the friction you can actually count on, and the wrap-angle arithmetic that decides whether a drive pulley slips.
- **The standards, side by side.** AS 1403, ANSI B105.1, ASME B106.1M and CEMA — and the new European pulley standard, VDI 3622 (July 2026), for anyone selling into Europe.
- **A working cost model.** Steel by thickness, machining, welding, locking assemblies, scrap — and design optimisation for lowest cost or weight.
- **What can be done by hand, and what can't.** Sitzwohl and the shaft codes reduce to a hand calculation. Lange's shell equations, end-disk stiffness and the split of the bending moment do not — which is one reason so few people can design a pulley. The class does the first by hand and the rest in Pulley Maven, on a live design, ideally one of yours, so it leaves knowing what each number means and where it came from.

The four days

DAY 1

Foundations and the Shaft

- Pulley design 101: shared moment, flexible vs rigid, load rating
- Deflection and stiffness: Euler–Bernoulli vs Timoshenko, and why the choice can pass or fail the same pulley
- A century of standards: **B17c 1927 → AS 1403, ANSI B105.1, ASME B106.1M, DIN 743**
- Size factor, surface finish, endurance limits, materials
- Worked example, first pass

DAY 2

The Shell

- Minimum diameters and standard sizes: **ISO 3684, CEMA B105.1, DIN 22101**, Renard numbers
- Sitzwohl — the loaded ring, and everything it cannot see
- Lange — moment theory of cylindrical shells; how he solved it and what it misses
- FEA done right: loads, constraints, mesh at the welds, and the checks that prove a model — benchmarked against Lange
- Seam weld to **DIN 15018**, thickness, and shell rolling

DAY 3

Locking Assembly and End Disk

- Locking assembly types: self-centring, self-locking, and the high-bending warning
- Clamping force, six catalogues compared, de-rating, reduced bolt torque, slip
- Stress concentration at the locking assembly: K vs b_k, notch sensitivity
- End disk stiffness three ways: Lange/Schmoltzi, BF Goodrich, FEA
- Reducing end-disk stiffness, and what each lever costs

DAY 4

Loads, Manufacturing, Optimisation

- Overhung load: rough estimate → better → actual design
- Lagging, ceramic lagging, and drive slip
- The new European pulley standard, VDI 3622 (July 2026), against what the room already knows
- Dead shaft, wing pulleys, and what a CEMA class really constrains
- Manufacturing steps, tolerances, and a cost model that works
- Product structure, BOM, configurator; design optimisation; the four reasons pulleys fail

The instructor

Andrew Hustrulid, PhD, PE

Thirty years in belt conveyors across the USA, Chile, Brazil, Australia and Germany — designing them, running the companies that build and service them, and working out why they fail. BSc, MSc and PhD from the Colorado School of Mines, where he teaches the Belt Conveyor Design short course. Vice chair of the CEMA pulley committee. Founder of Hustrulid Technologies and author of Pulley Maven, Conveyor Maven and Chute Maven.

This course has previously been delivered to pulley manufacturers in APAC and Europe.

Pulley Maven in the course

Participants work in Pulley Maven from Day 1: entering shaft and shell geometry, selecting the locking assembly from the catalogue, running the model at run and maximum tensions, and reading the results — displacements, stresses, the design criteria page, and the model check that proves the FEA balances. By Day 4 the class has costed the same design from its bill of material and operations and searched it for the lowest-cost combination of steel, machining and locking assembly. Bring your own pulleys; the software is provided for the course.

Format

WHERE

At your facility, worldwide.

DURATION

Four days, 08:30–16:30.

WHO ATTENDS

Your engineering, design, and specification team. Bring current pulley designs — the worked examples can be yours.

LANGUAGE

English.

INCLUDED

Course notes; the reference library of standards and papers behind every session, issued before Day 1; Pulley Maven access during the course.

PRICING

On request. Scheduled to suit your team.

Bring it to your team

To discuss dates, scope, or whether it fits your engineers, contact Andrew directly.

andrew@hustrulid.com · www.hustrulid.com · www.pulleymaven.com · linkedin.com/in/hustrulid