

Hear a tread pattern's tone before you cut the mould.

PATCH takes the pitch lengths and tread-block images for a tyre, searches five million block arrangements, and returns the sequence that spreads impact energy across the spectrum instead of ringing on one tone. Play the result back and hear the difference before the mould is cut.

THE PROBLEM IT SOLVES

Uniform pitching rings on one tone

A tread cut with every block the same length puts all of its impact energy at a single frequency, the whine a driver notices. Vary the block lengths and that same energy spreads into broadband hiss instead. PATCH searches for the arrangement that spreads it furthest, using the pitch types you already have.

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1 Enter the tyre and pitch types

Choose passenger car or truck and bus, then enter the outer diameter, tread arc width, reference speed and total pitch count. A length, a count and a tread-block image for each pitch type supply the rest.

- Symmetric patterns, or asymmetric ones with separate inner, centre and outer bands.
- A live design check confirms the counts and lengths close to the circumference before a run can start.
- Load and inflation set the footprint length, or type in a measured one.

2 PATCH reads the images itself

Land and groove are found straight from a plain tread-block image, light-on-dark or dark-on-light. No tracing and no scale to set.

- A crop check shows the tiles exactly as PATCH classified them, with the land ratio, before you confirm.
- The typed length and the image are cross-checked, so a wrong crop or a wrong tread arc width is flagged.
- A shared leading-edge profile sets how much of each block touches down at once.

CHECK THE CROPS

3 It searches five million arrangements, and you can listen

Twenty restarts, four to five minutes, with no more than three adjacent blocks of the same length where the pitch counts allow it. Switch the sound on and hear the tone break up as the run progresses.

- Compare three clips of one revolution at your reference speed: optimised, uniform pitching and the best random sequence.
- Clips are level-matched, so only the tonal character differs.

LISTEN: SAME IMPACTS, REARRANGED

▶ Optimised

▶ Uniform pitching

▶ Best random

5,000,000

Arrangements tried per run, across twenty restarts.

4-5 min

From a ready pattern to an optimised sequence.

3

Adjacent blocks of the same length allowed, at most.

Local

All calculation runs on your computer.

Every sequence balances three things at once

Alongside the tonal peak, each candidate is checked against three constraints. Each adds a term to the cost the optimiser minimises, so switching one off changes the sequence it returns.

- Balancing.** Keeps long and short blocks from collecting on one side of the tyre.
- Mould-segment noise.** Suppresses orders that repeat with the number of mould segments.
- Tyre cavity noise.** Keeps block energy off the tyre's air-cavity resonance.

Compound inputs (optional)

Left off, every block strike is modelled as a clean impulse and the result depends on the pattern alone. Switched on with a tan δ figure, from storage modulus E' or Shore A hardness, the optimiser also steers the sequence away from the block's own resonance. Stiffness sets that resonant frequency, and tan δ sets how quickly it rings down.

RESULTS YOU CAN ACT ON

See where the energy went

ESTIMATED LEVEL

69.5 dB(A)

±3.5 dB · PCR · generic coefficients · at 80 km/h

Tonal peak is 20.3 dB below uniform pitching, and 2.60 dB below a typical random draw. Total A-weighted energy falls 1.26 dB — sequencing redistributes energy across frequency rather than removing it, so the level moves far less than the tonal figure suggests. The level above uses generic coefficients, so treat it as ±3.5 dB — sound for ranking designs, not for stating margin to a limit. Fit the calibration table to tighten it.

TOTAL ENERGY	TONAL REDUCTION	BLOCK-PASS	GROOVE RESONANCE	CAVITY MODE	AIR PUMPING	BALANCE	MOULD SEGMENTS
1.26	20.3	685	1409 Hz	216 Hz	none	0.012	9
<small>dB below uniform, A-weighted</small>	<small>dB below uniform pitching</small>	<small>Hz at 80 km/h</small>	<small>4 grooves measured · order 127</small>	<small>±10 Hz loaded · centre 9.0 mm assumed · orders 19–20 at -59 dB</small>	<small>no enclosed pockets — every void vents</small>	<small>1st-order imbalance · 0.3% of mean pitch</small>	<small>6.9 pitches each (6–8) · joint tone 99 Hz</small>

Result. Estimated level, tonal reduction, block-pass, groove resonance, cavity mode and balance, in one view. Example run on sample pitch data.

SPECTRUM

band level, dB(A), anchored to 72.0 overall

SEQUENCE LAYOUT

62 blocks · mean pitch 32.43 mm · pitch ratio 1.421 · scale ×0.9992

AAACCAACBC AABBCBBAAB CBAACCAABC BCBCAABAB CBBABBBAAAC CCABCABBAB CC

A · 27.08 mm · x22 B · 32.27 mm · x20 C · 38.47 mm · x20

Spectrum and sequence layout. Optimised sequence against the best random one, with the resonances marked. Example run on sample pitch data.

Read, compare and export

- Spectrum of the optimised sequence against the best random one, with groove, cavity and block resonances marked.
- Sequence layout around the circumference.
- Up to five saved runs compared side by side.
- Export the sequence and spectrum as CSV, copy the sequence, or write a Word report.
- Save the whole session to one project file and reopen it later without re-running the search.

Predicted level, honestly stated

PATCH estimates tyre noise in dB(A), anchored to a C1 reference for PCR and a C3 reference for TBR. With generic coefficients the level carries about ±3.5 dB: enough to rank designs, not to state margin against a limit. Paste your own measured tyres to calibrate it and tighten the estimate.

AI insights, once a run finishes

A plain-language read of the results, generated from the numbers on the results step: what each figure means, strengths against weaknesses, and the highest-impact change to try next. It is an aid to reading the output, not a substitute for confirming on a real tyre.

Your patterns stay on your computer

PATCH runs as a desktop application and does all of its calculation locally. No pitch image, tread geometry or sequence is uploaded anywhere.

PLATFORM	CATEGORIES	INPUTS	OUTPUTS
Windows desktop application, delivered as a single .exe. Nothing else to install.	Passenger car radial and truck and bus radial, calibrated separately.	Tyre geometry, pitch lengths, tread-block images, leading-edge profile.	Sequence, spectrum, CSV exports, Word report, project file.