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BARBER'S POLE EFFECT AT INDUCTION HEATING OF STEEL SHAFT

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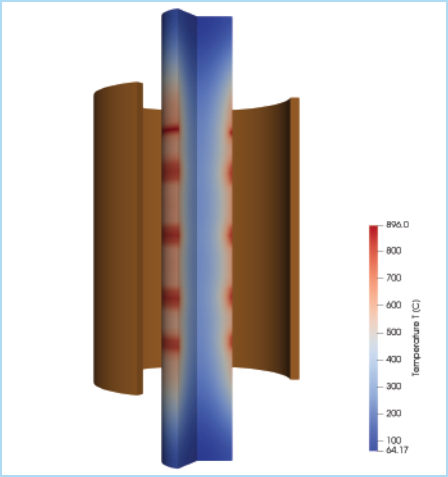
Barber's pole effect

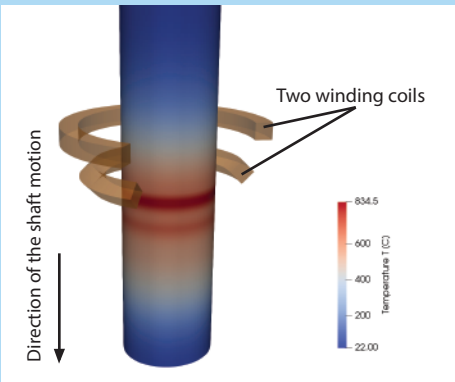


- Appears when the temperature approaches Curie point
- The number of stripes depends on the frequency
- It is observed in a narrow power range
- In computer simulations stripes are observed also for infinite current sheet => **stripes are not created by the inductor asymmetry**

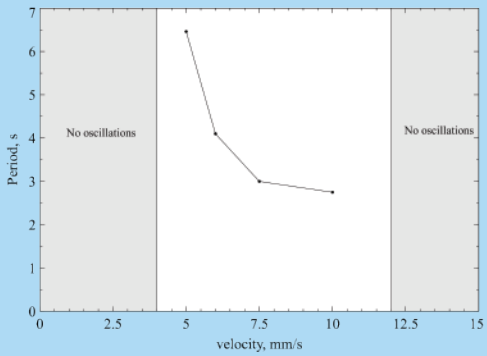
Barber's pole and **striation** effect is a localized overheating as a result of magnetic field re-distribution in vicinity of the regions when temperature locally has passed Curie point and, consequently, the material locally lost ferromagnetic properties.

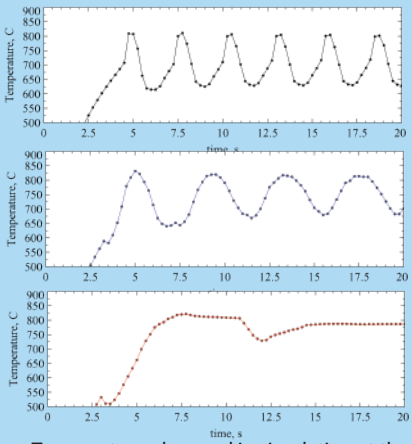
Rudnev, V.I. (2008). Mysteries in induction heat treating: striping (striation) phenomena. Heat Processing, Jan. 2019, 63

Simulation of shaft scanning



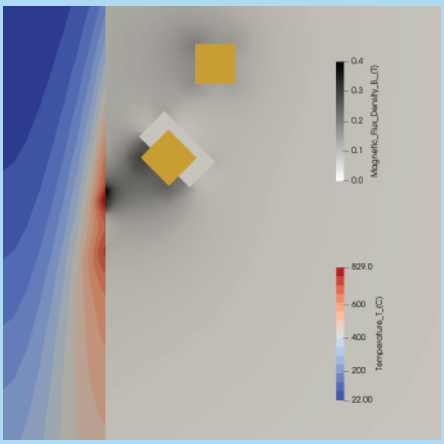
Numerical simulation was done with scanning of ø52 mm low carbon steel 1020 shaft. Used frequency 15 kHz, current 3600 A.



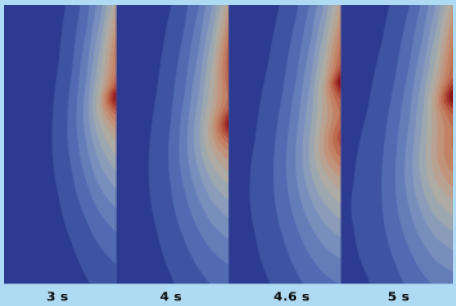


Temperature observed in simulation at the point on the surface of shaft. Different scanning velocity was used (from top to bottom) 10 mm/s, 6 mm/s 4 mm/s)

- Oscillations appear in narrow range of scanning velocities
- For velocities below threshold, workpiece heats well above Curie point and no oscillations occur
- For velocities above threshold, workpiece does not reach Curie temperature.



2D simulation of induction heating of shaft with scanning. **Magnetic field intensity** is shown in grayscale.



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