Wrocław University of Science and Technology

Faculty of Geoengineering, Mining and Geology

Digital Mining Center

Local damage detection – filtering optimisation via GA

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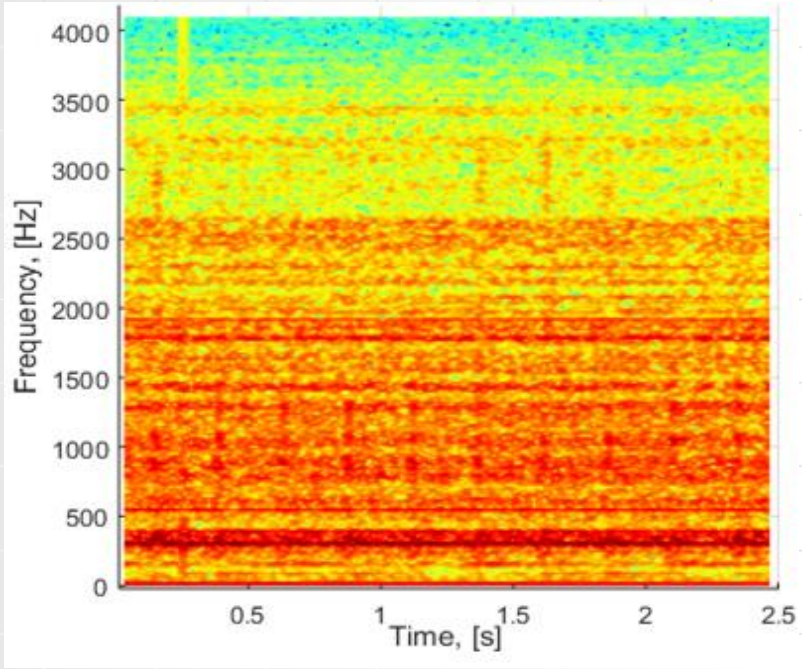
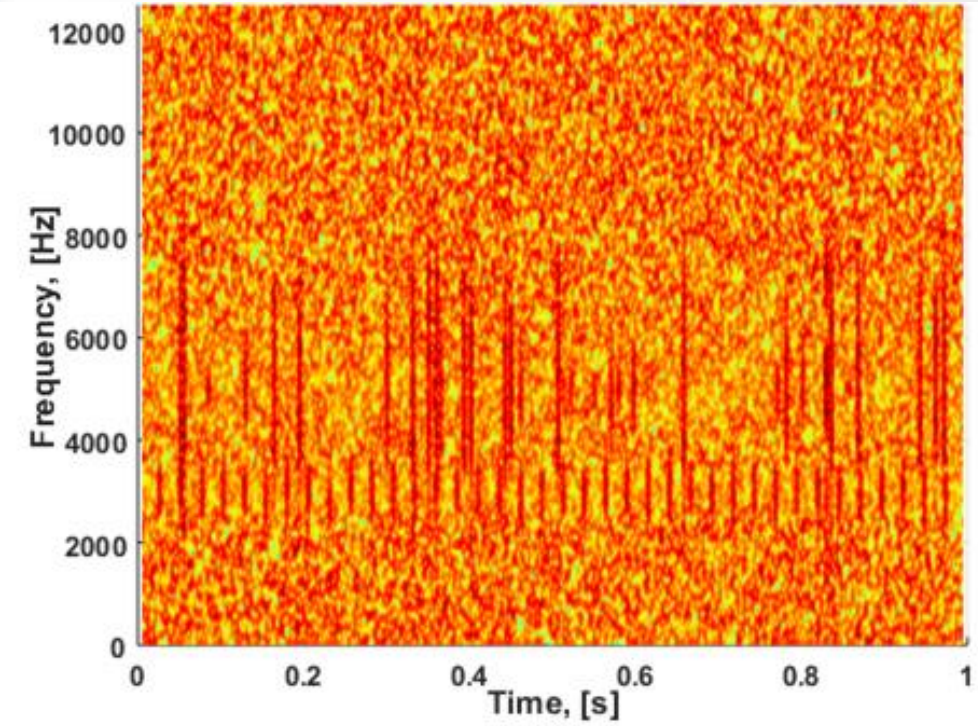
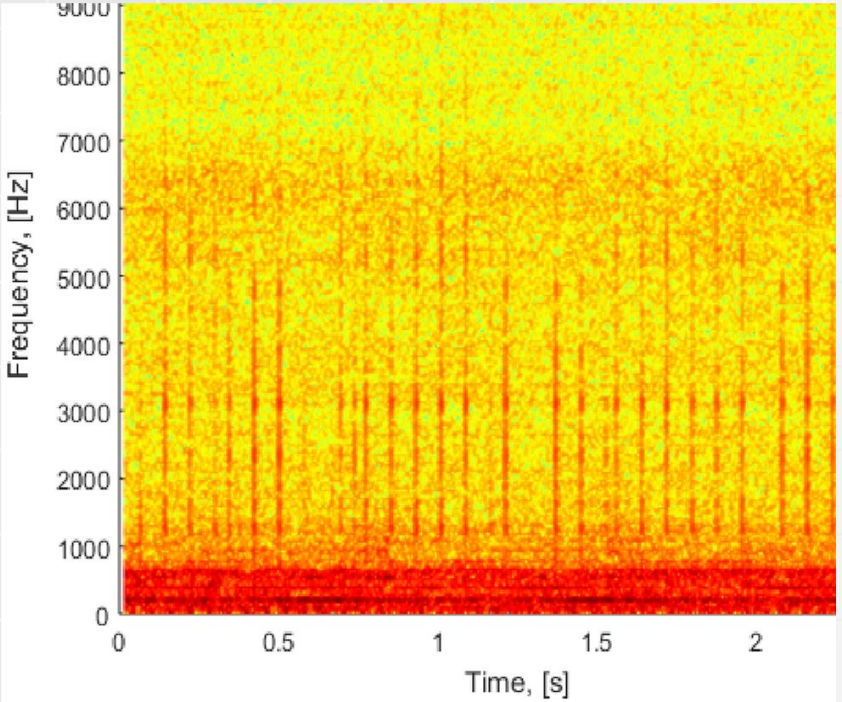
Problem

Specificity of identification – many impulsive components can be present
Selectiveness – frequency band of cyclic component can be limited and relatively narrow
Sensitivity – SNR of informative component can be low







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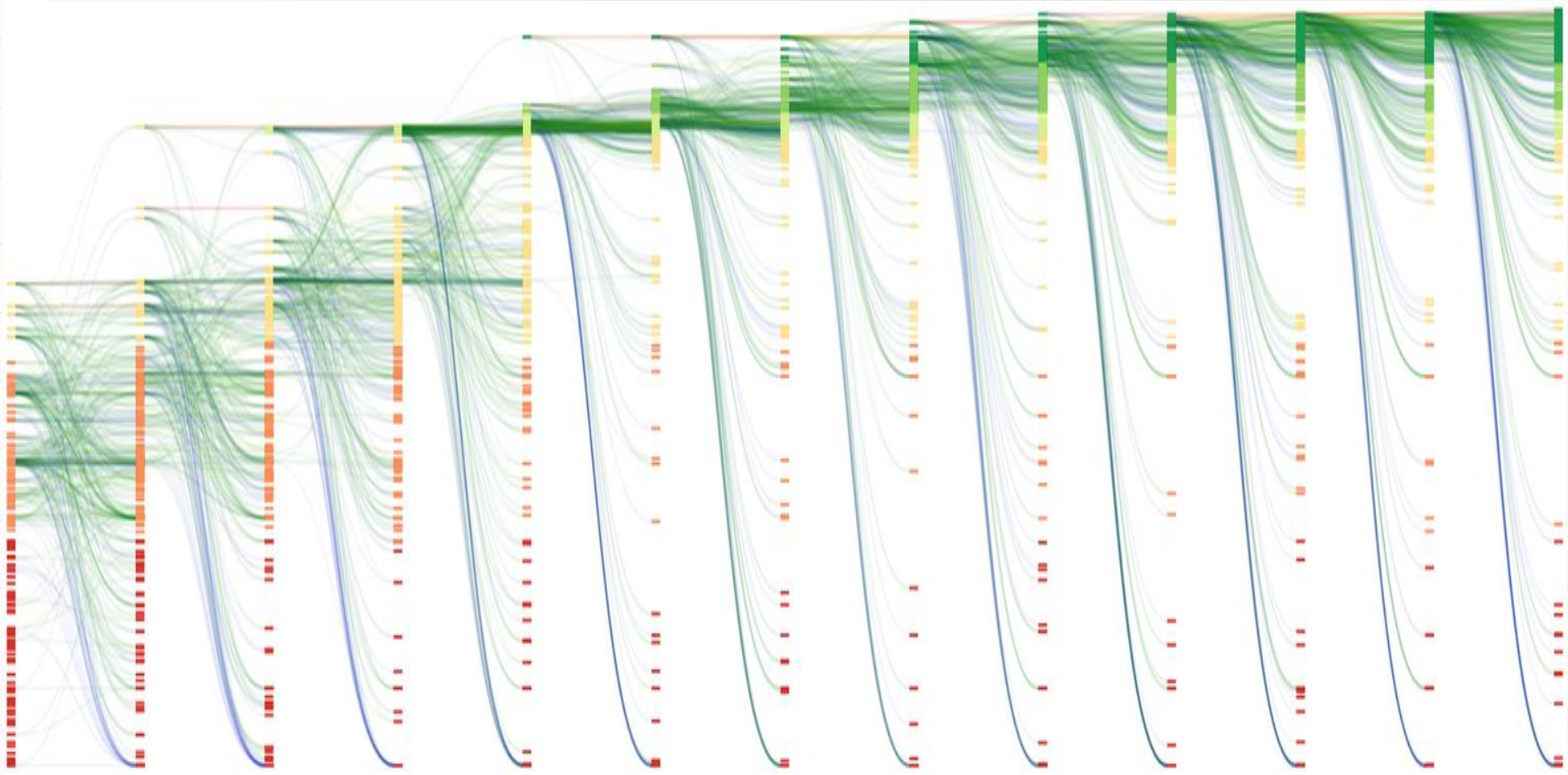
Genetic Algorithm – biology-inspired population-based optimization



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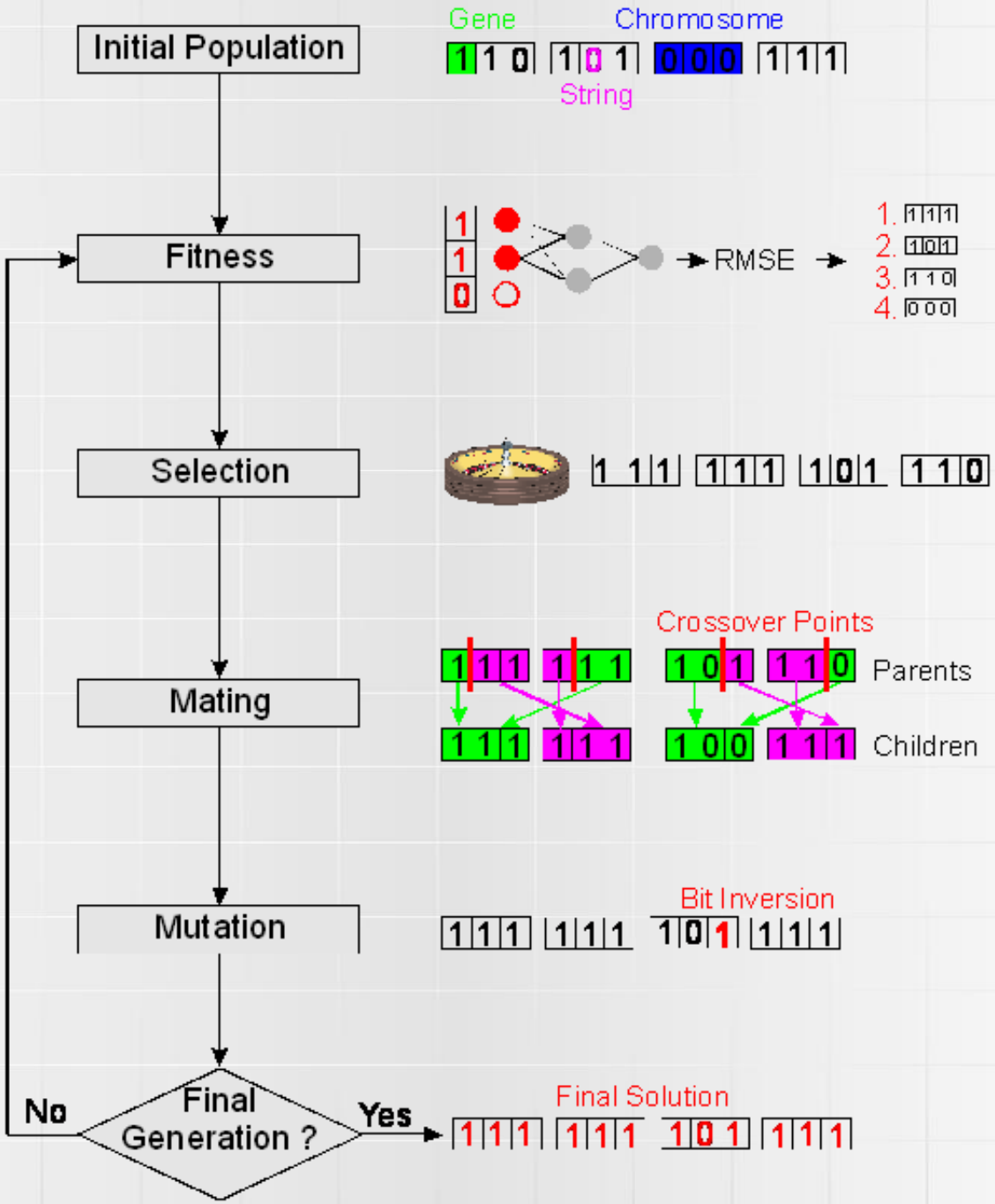
Genetic Algorithm



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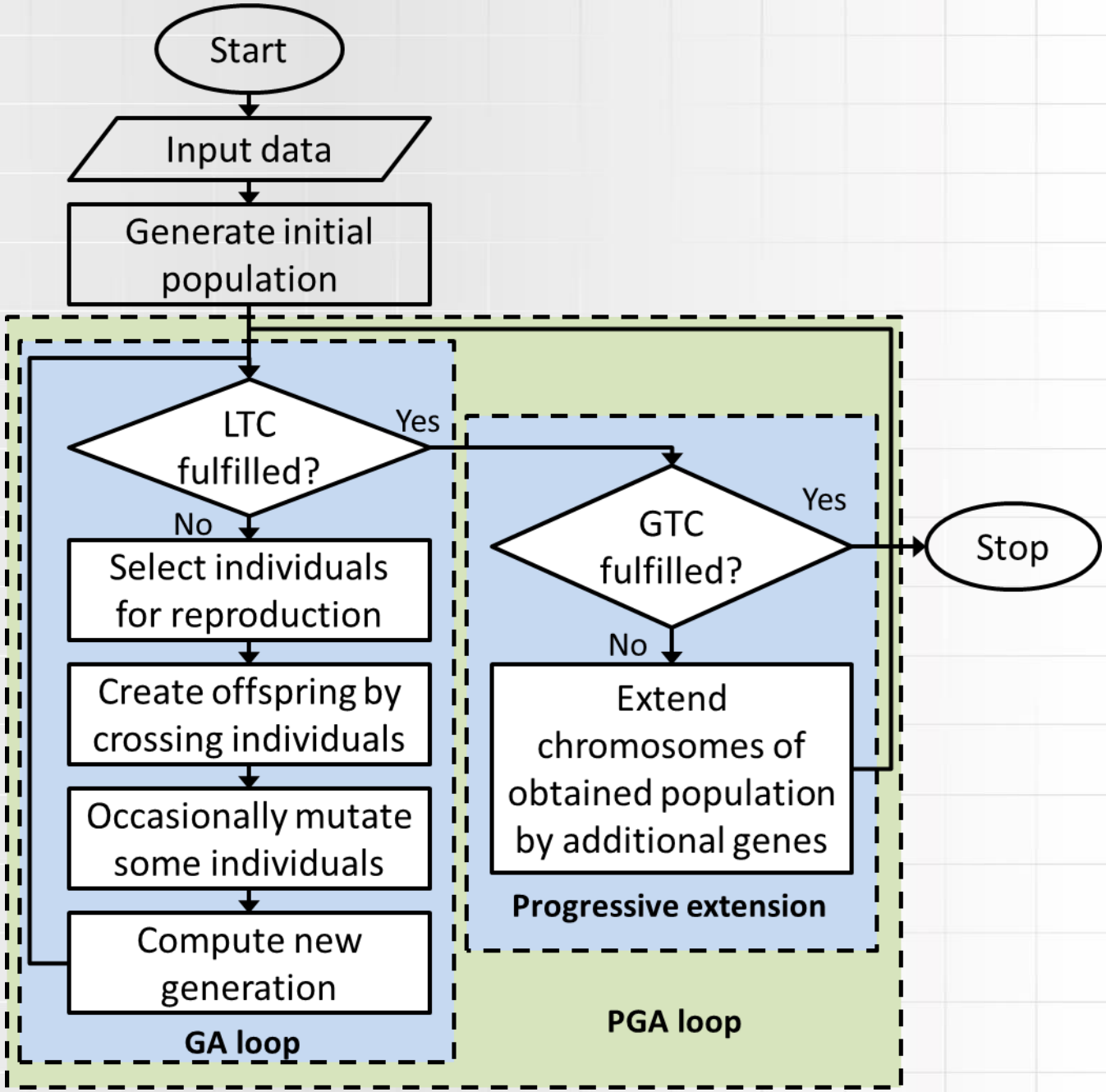
Progressive Genetic Algorithm

LTC – local termination criterion
GTC – global termination criterion



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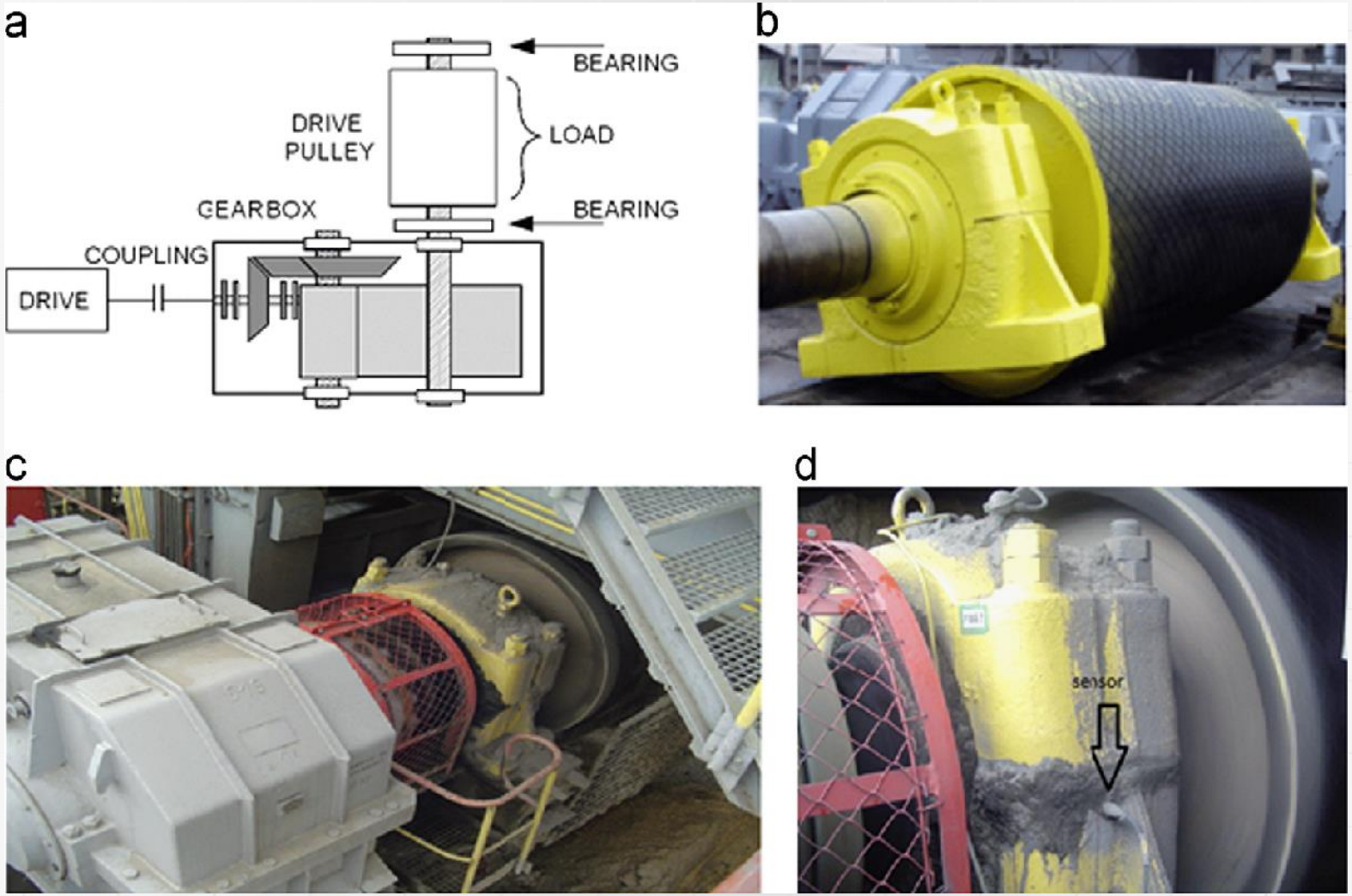
Testing

The object of investigation is a damaged bearing of a drive pulley operating within a driving station of the belt conveyor.



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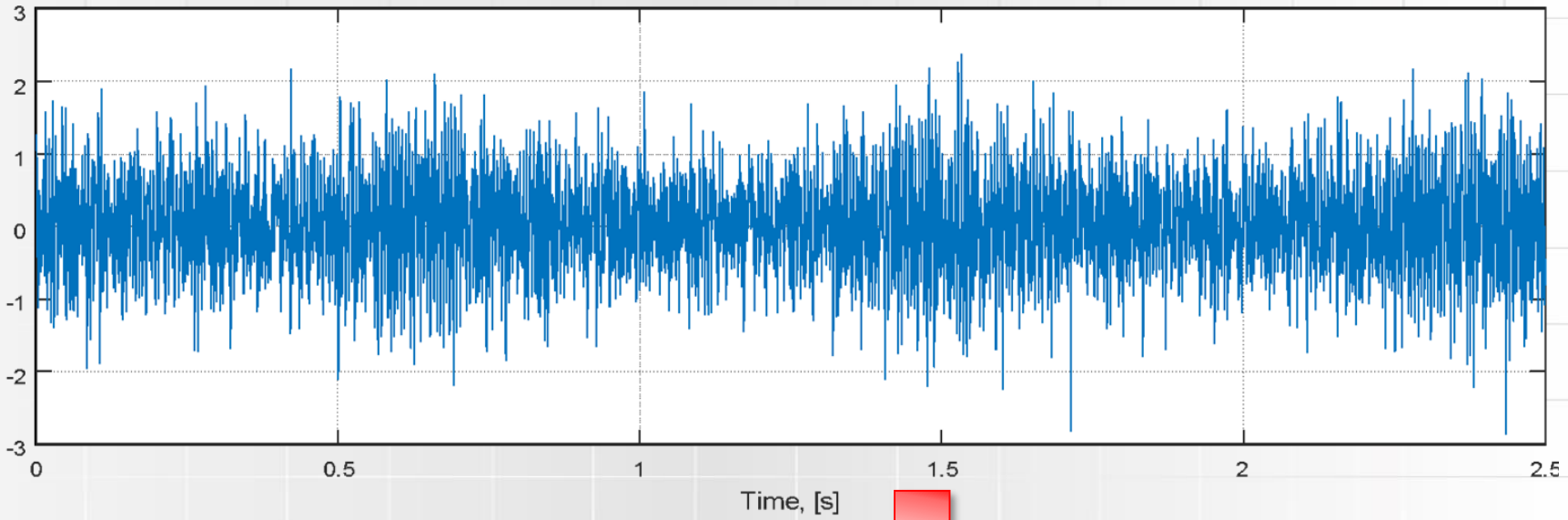
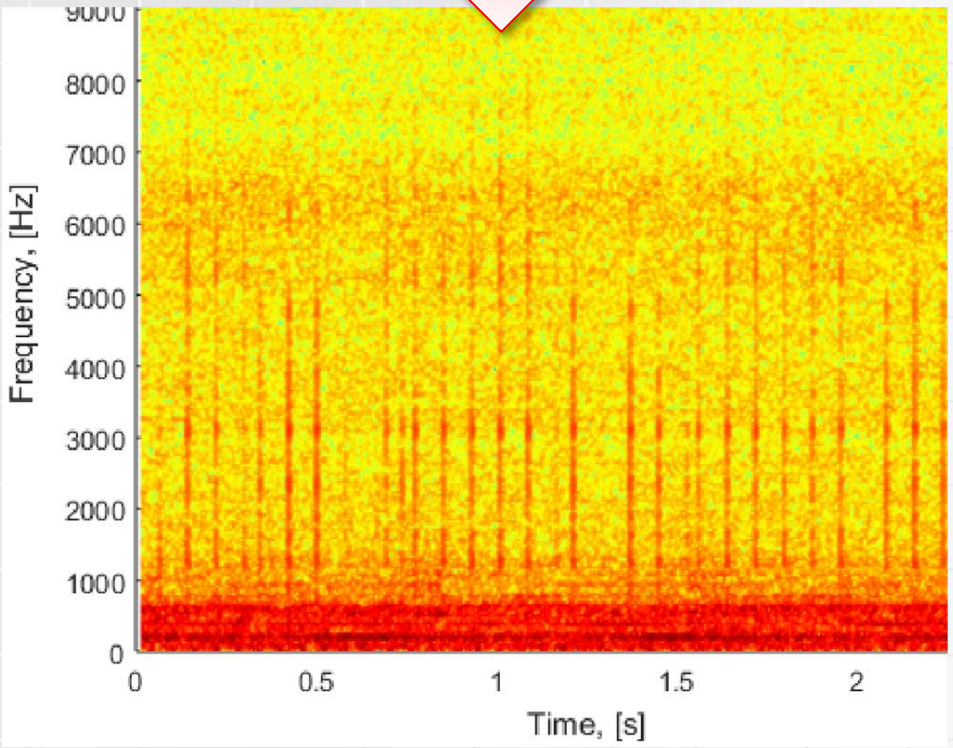
Data



Spectrogram reveals the presence of impulses in the signal.



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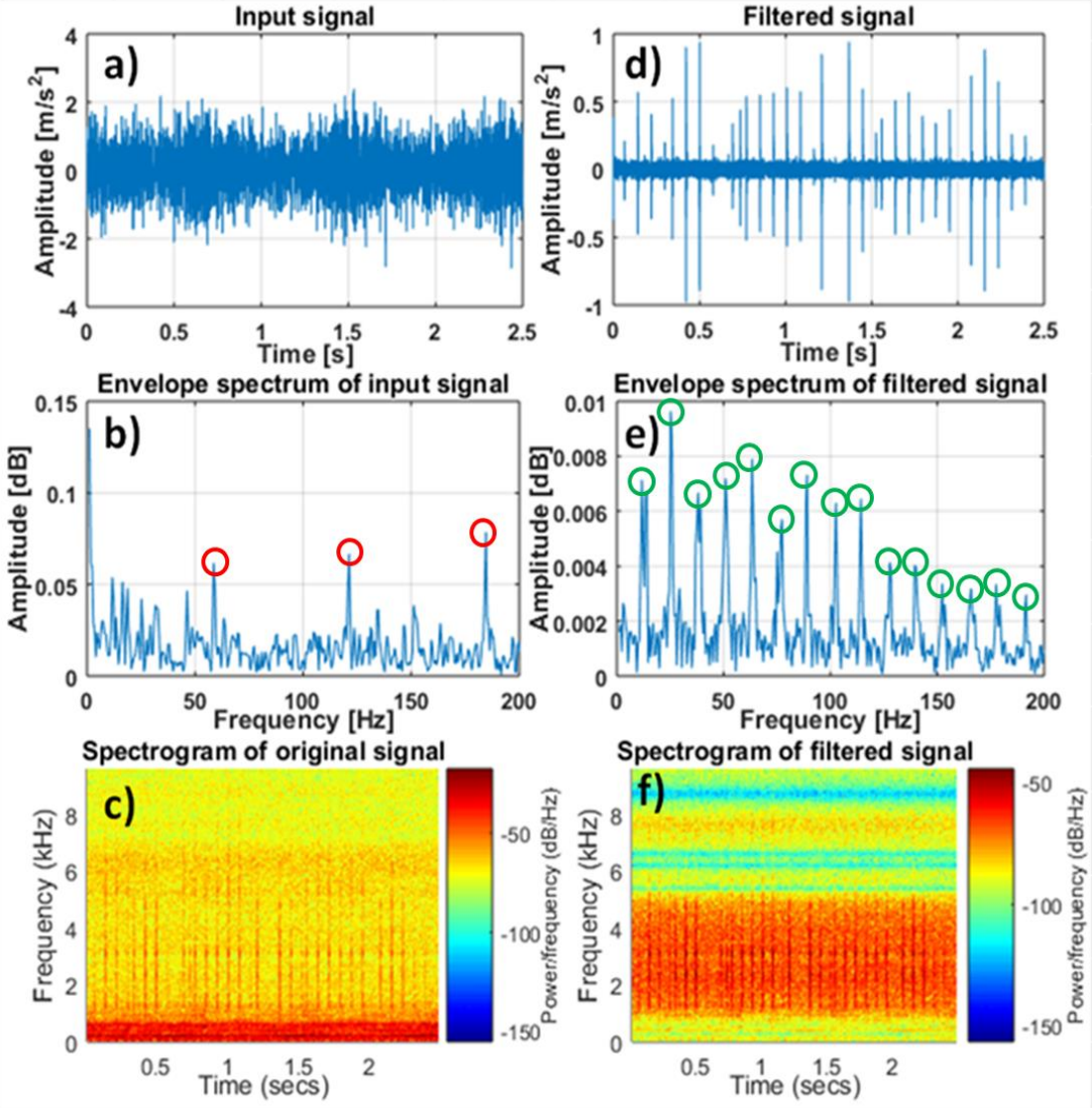
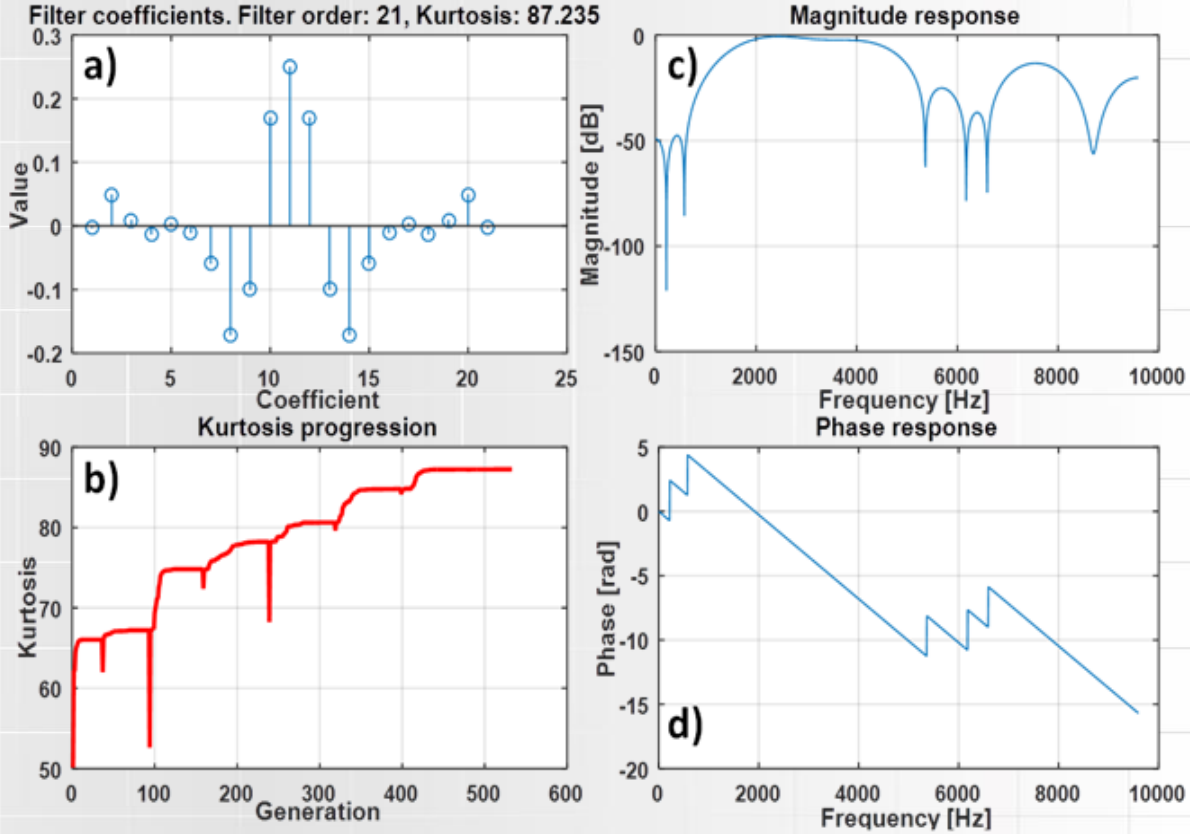
Results





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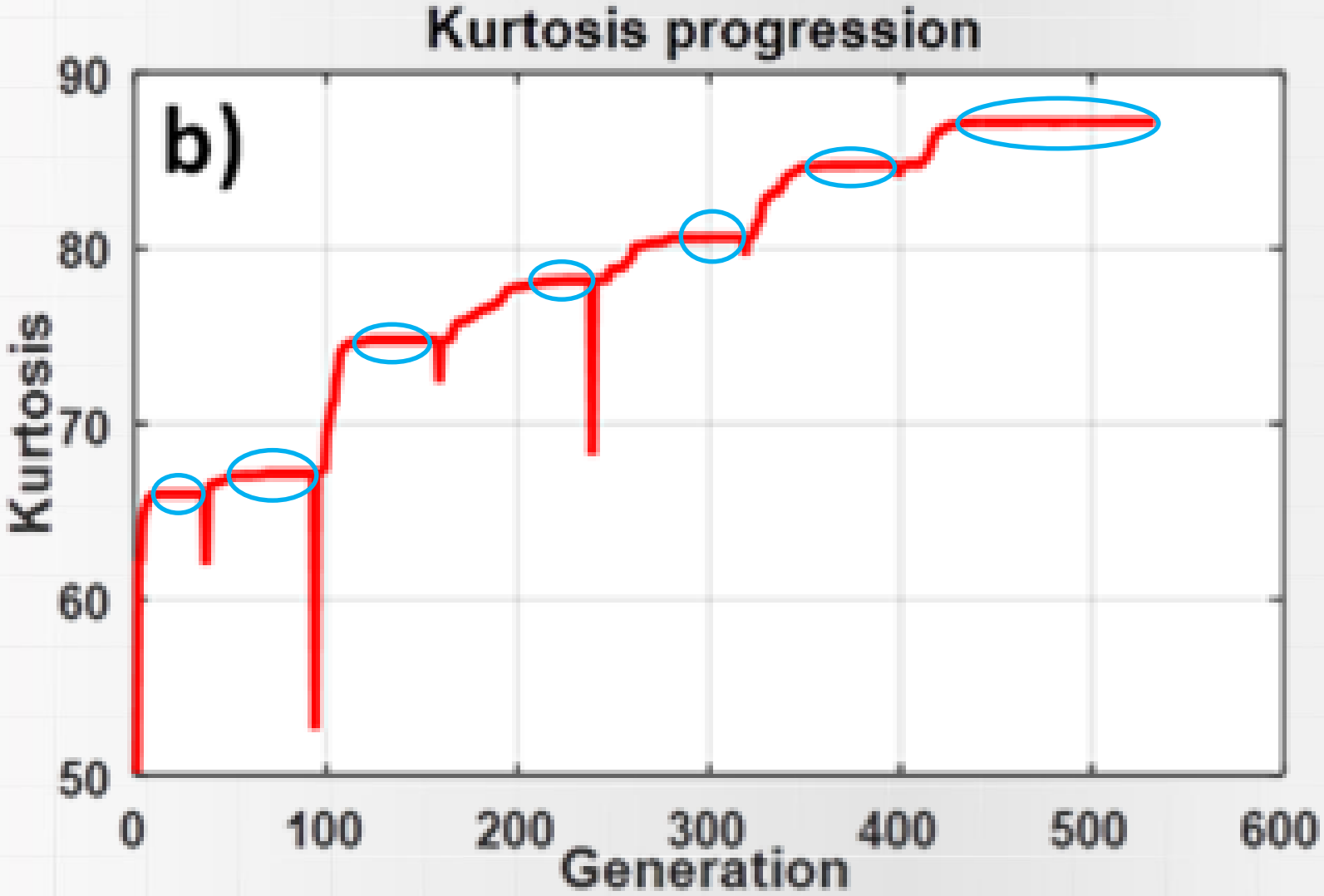
Observation 1: time is wasted



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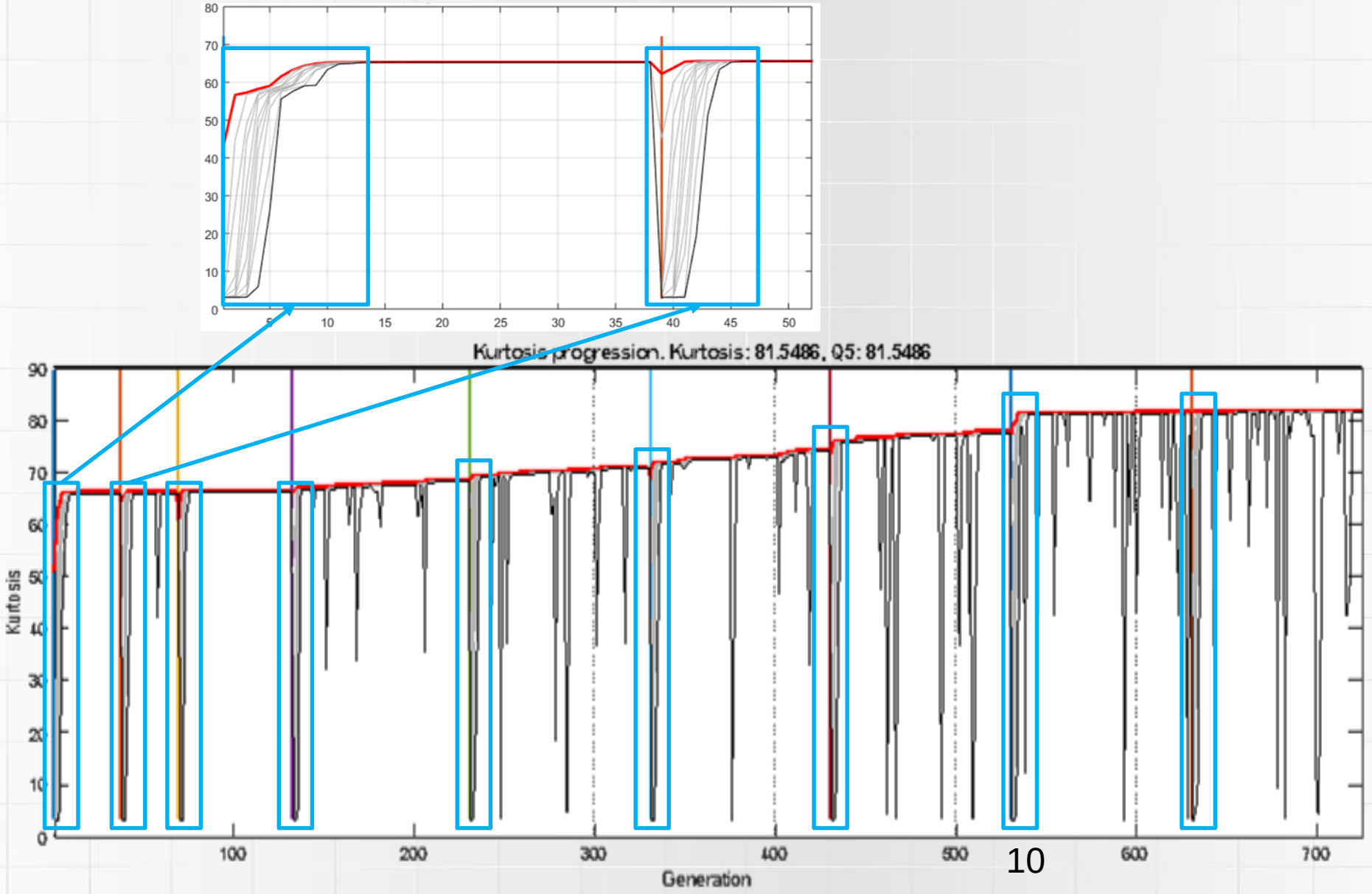
Observation 2: population becomes saturated



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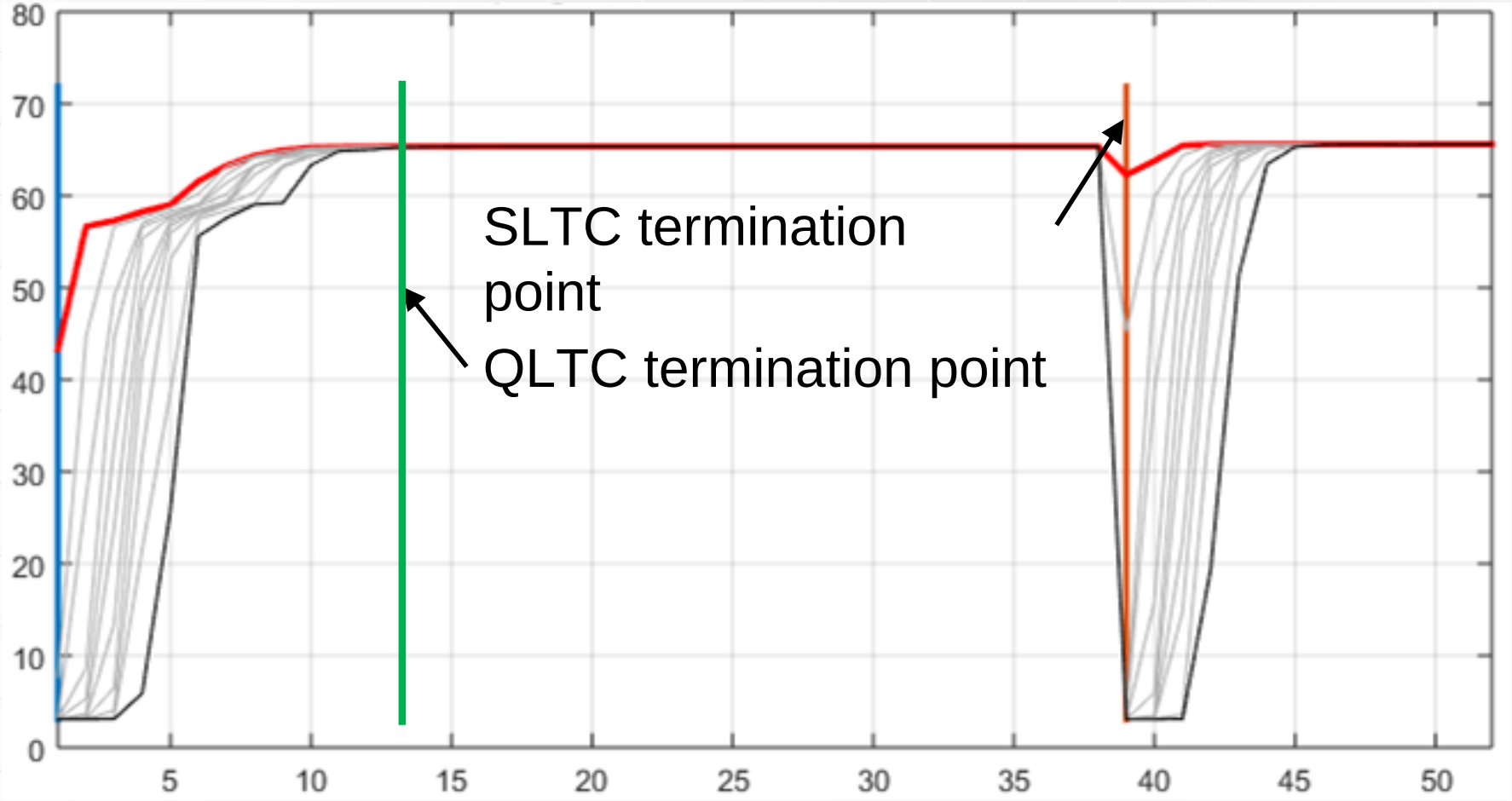
Solution: quantile-based LTC

$$q_{0.05} \geq 0.99 * fitness$$

Fitness
Quantile 10:10:90%
Quantile 5%



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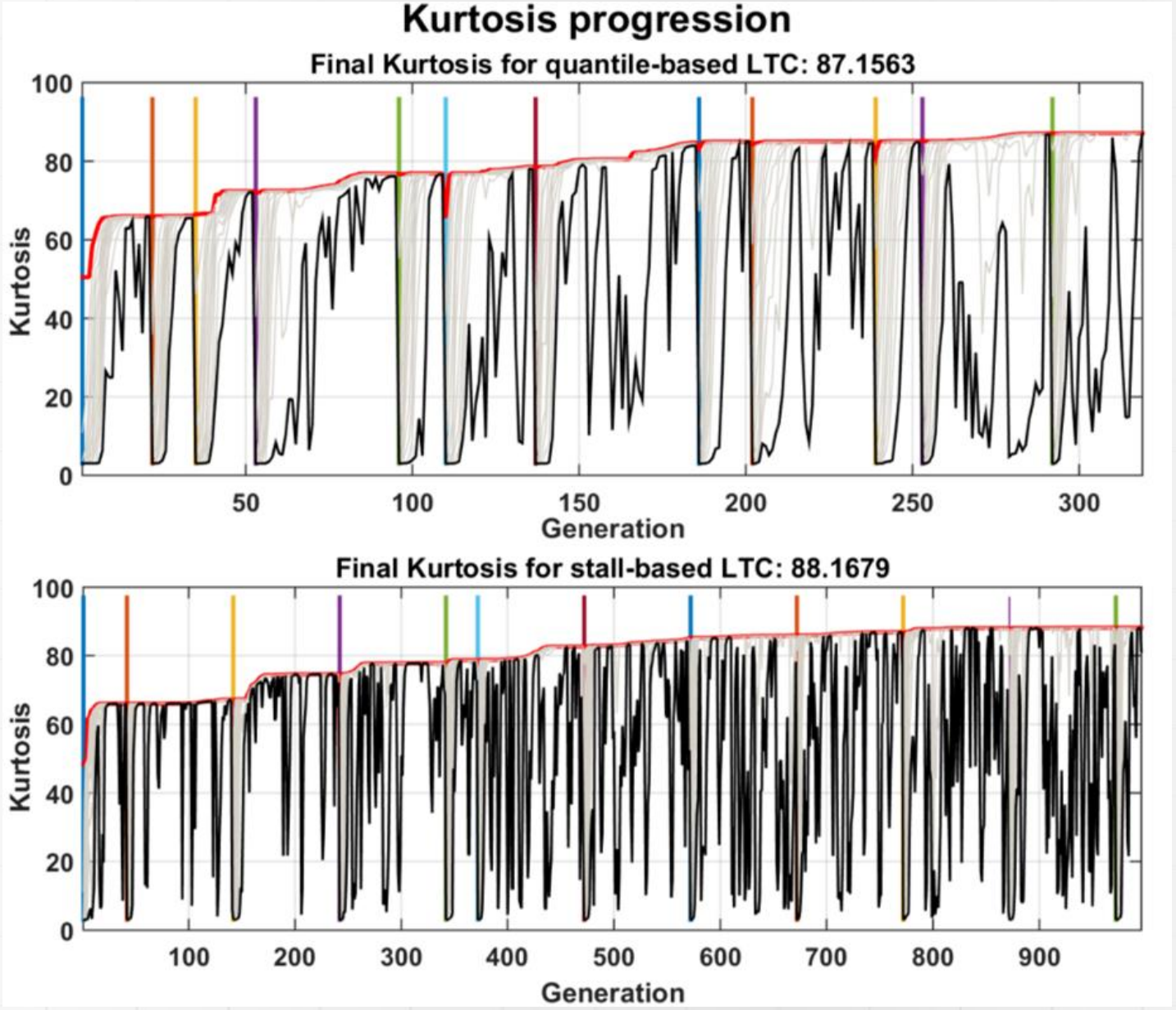
Performance: ~64% time reduction



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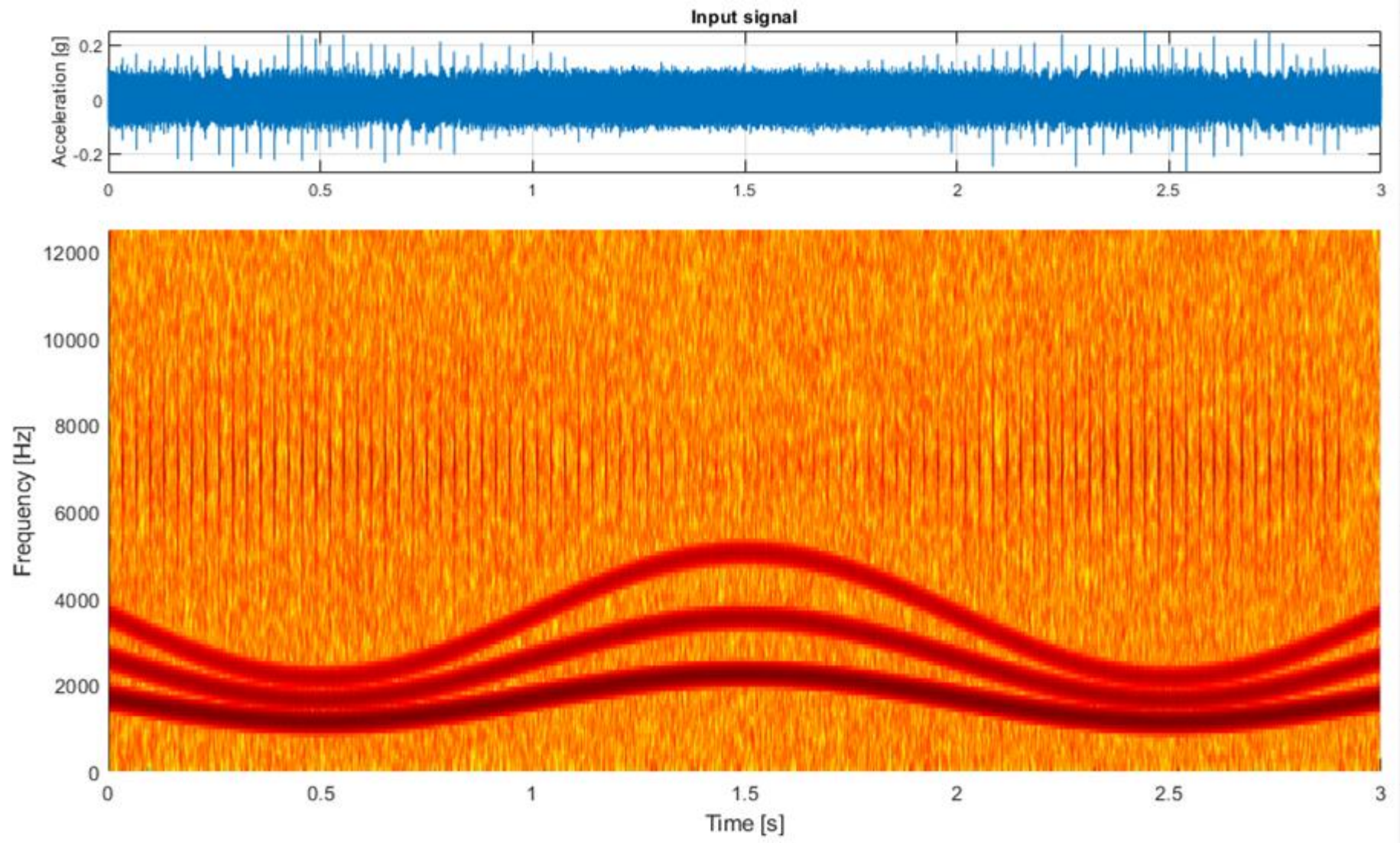
Problem: time-varying operational conditions



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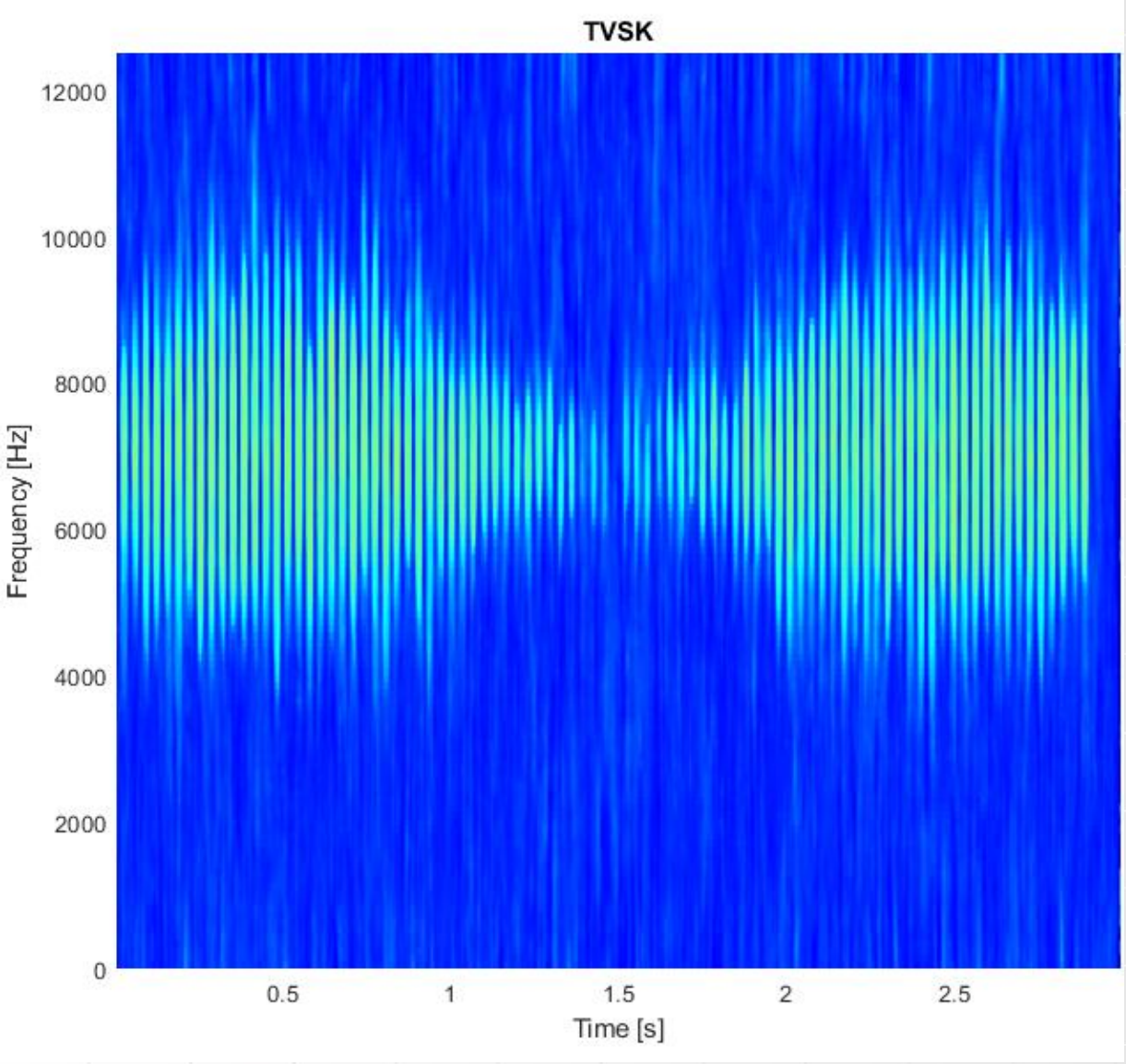
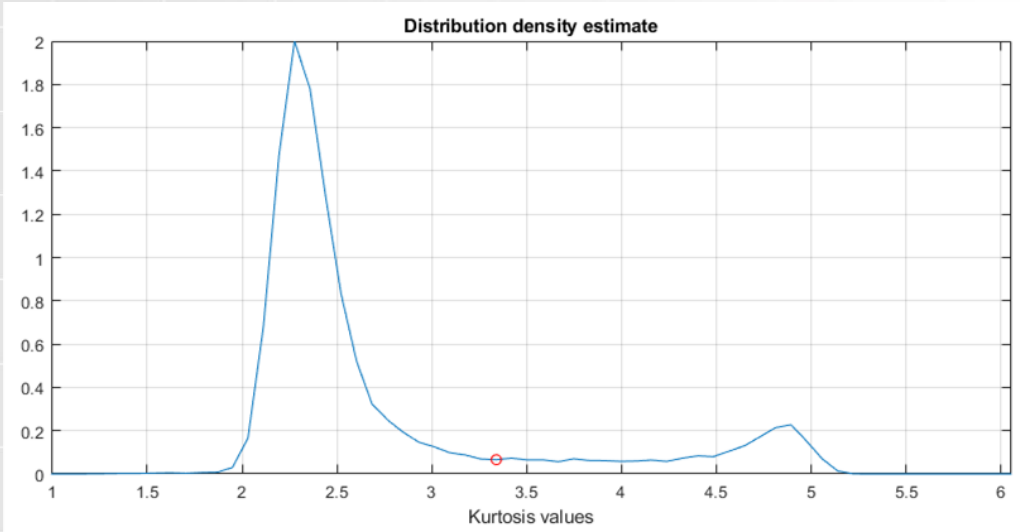
Solution: 2D filter





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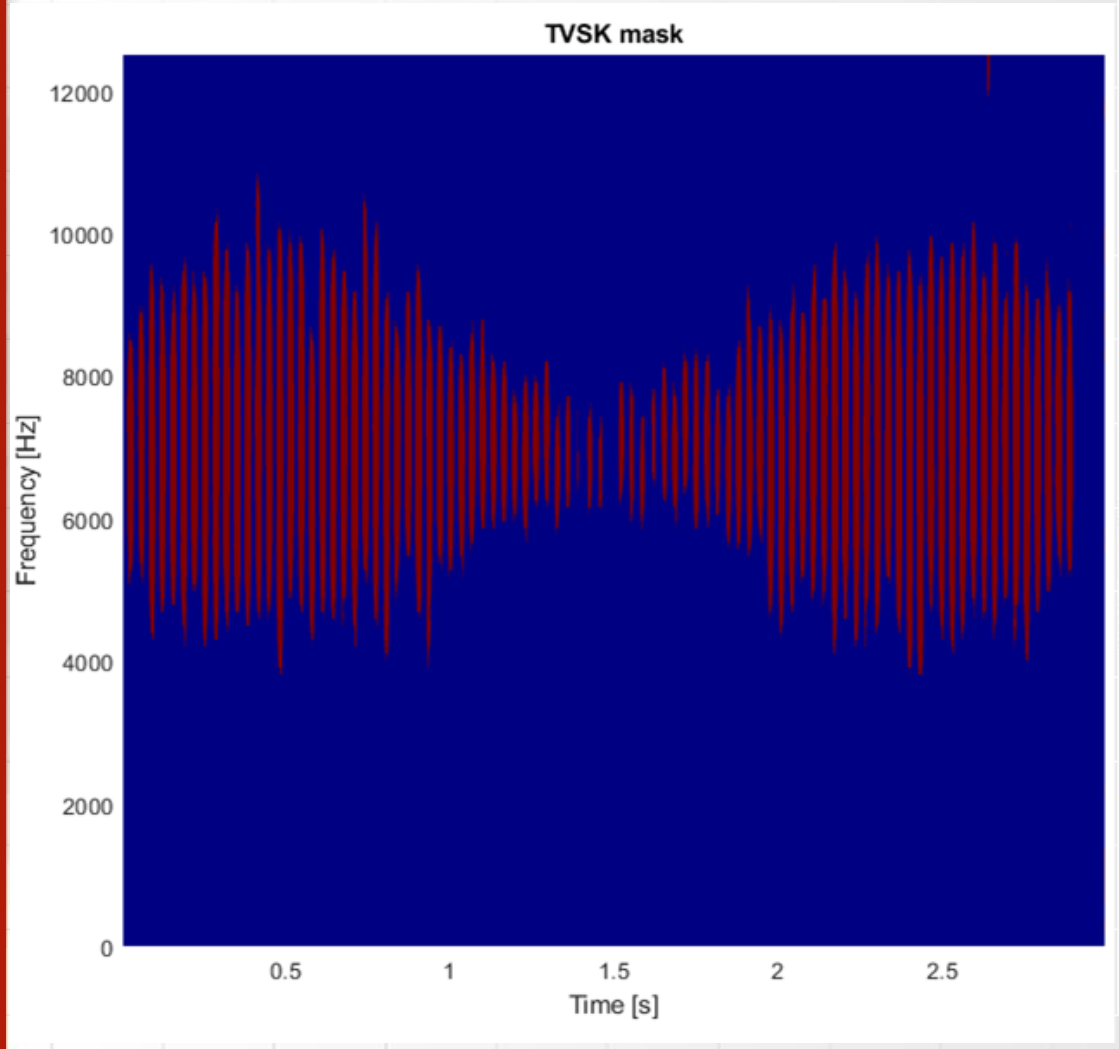
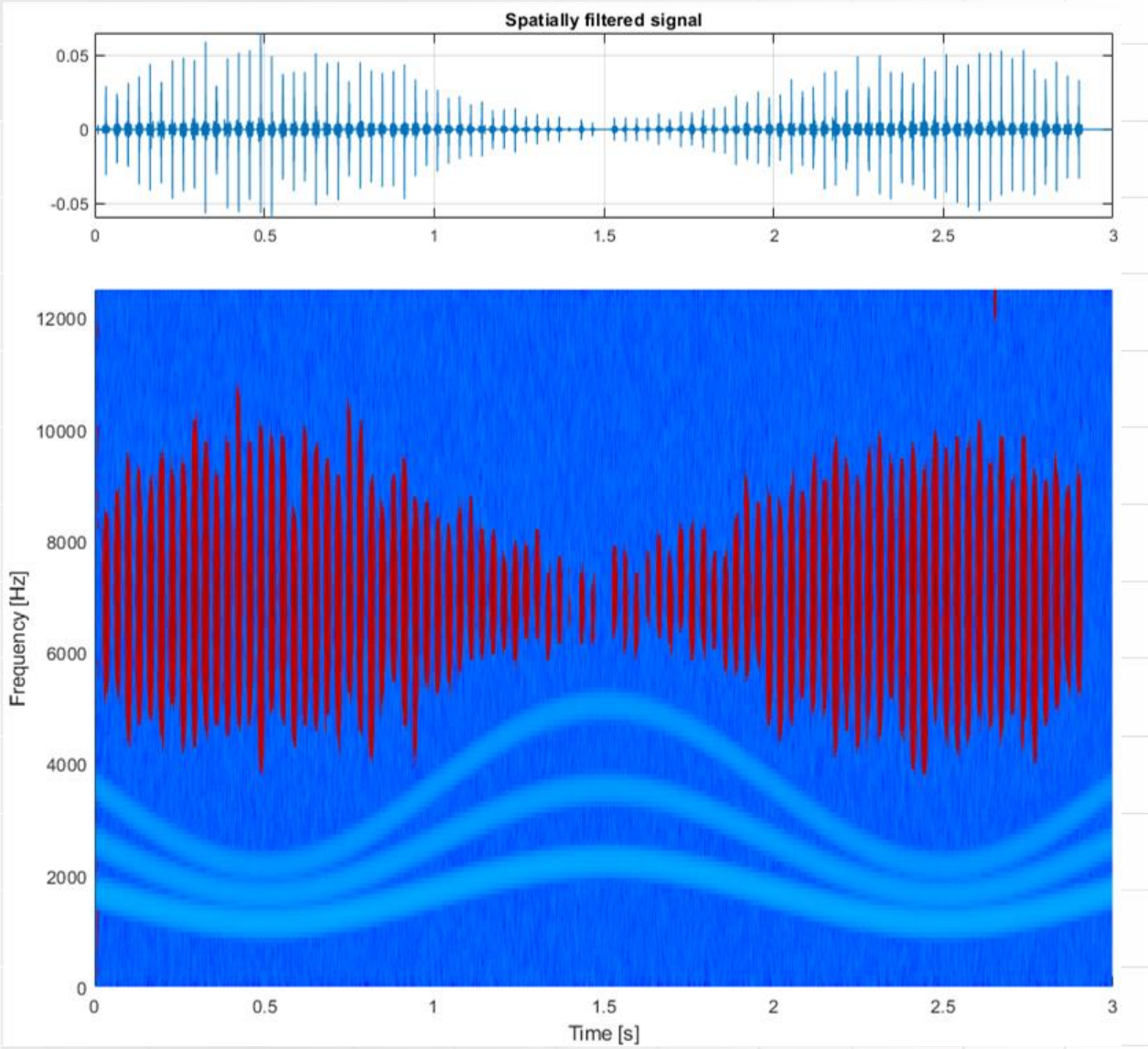
Results





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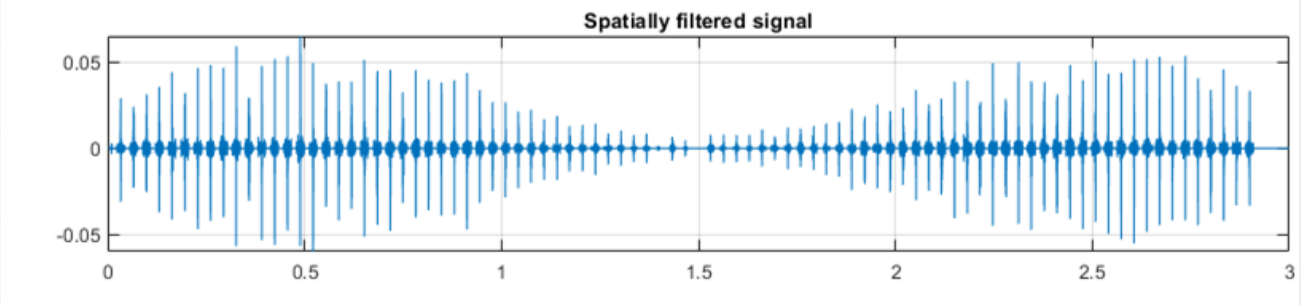
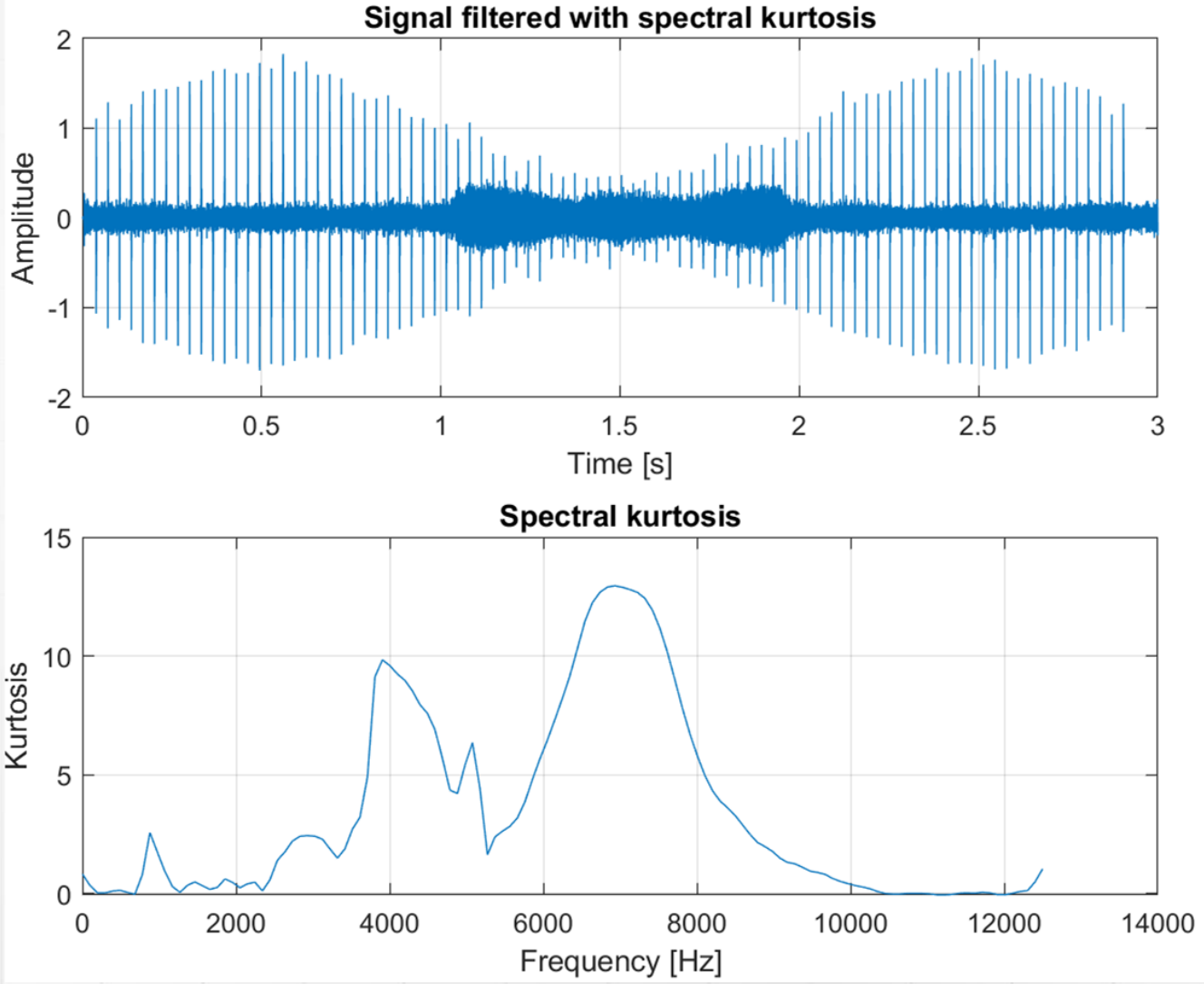
Comparison





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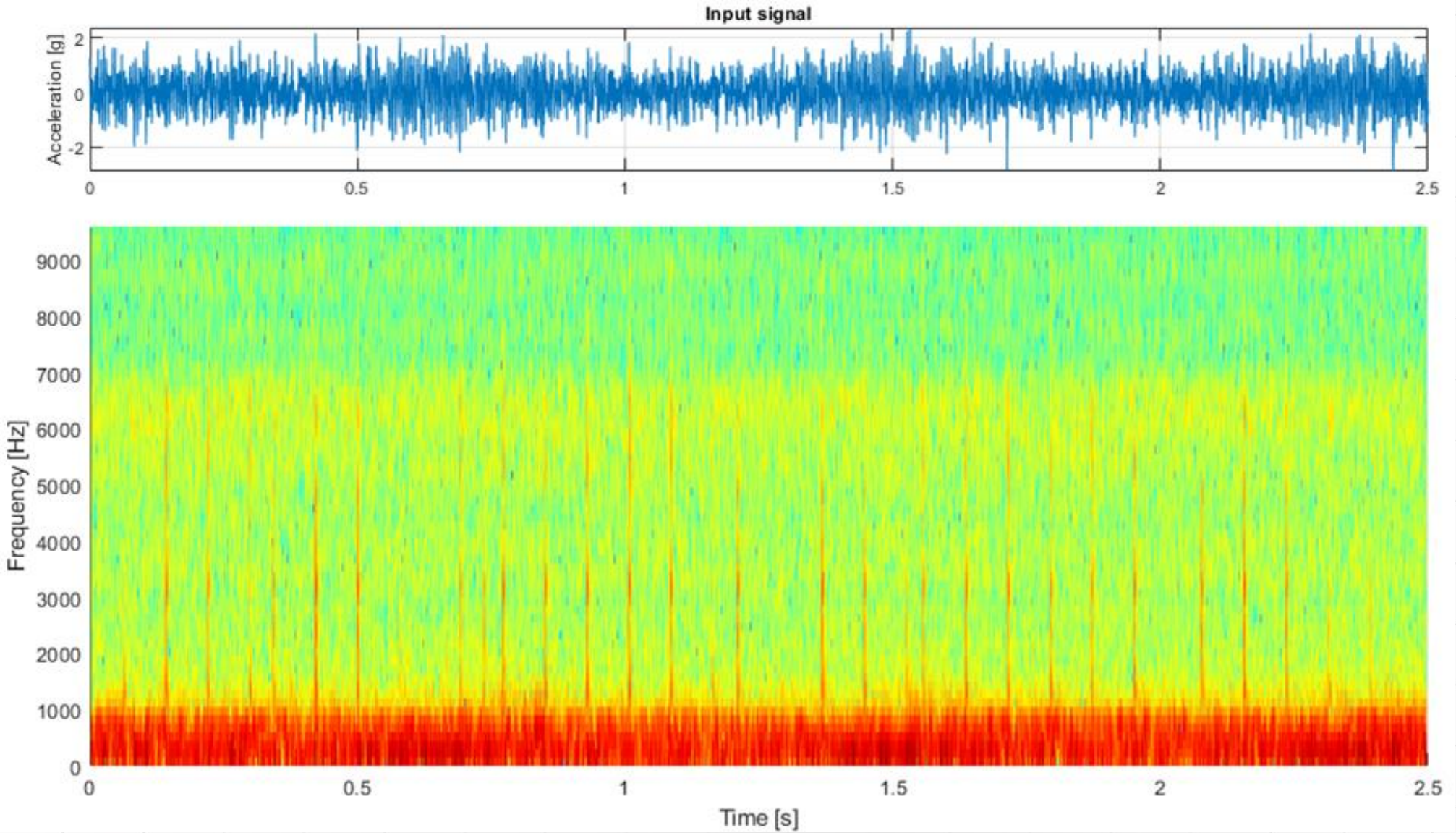
Real case: pulley bearing



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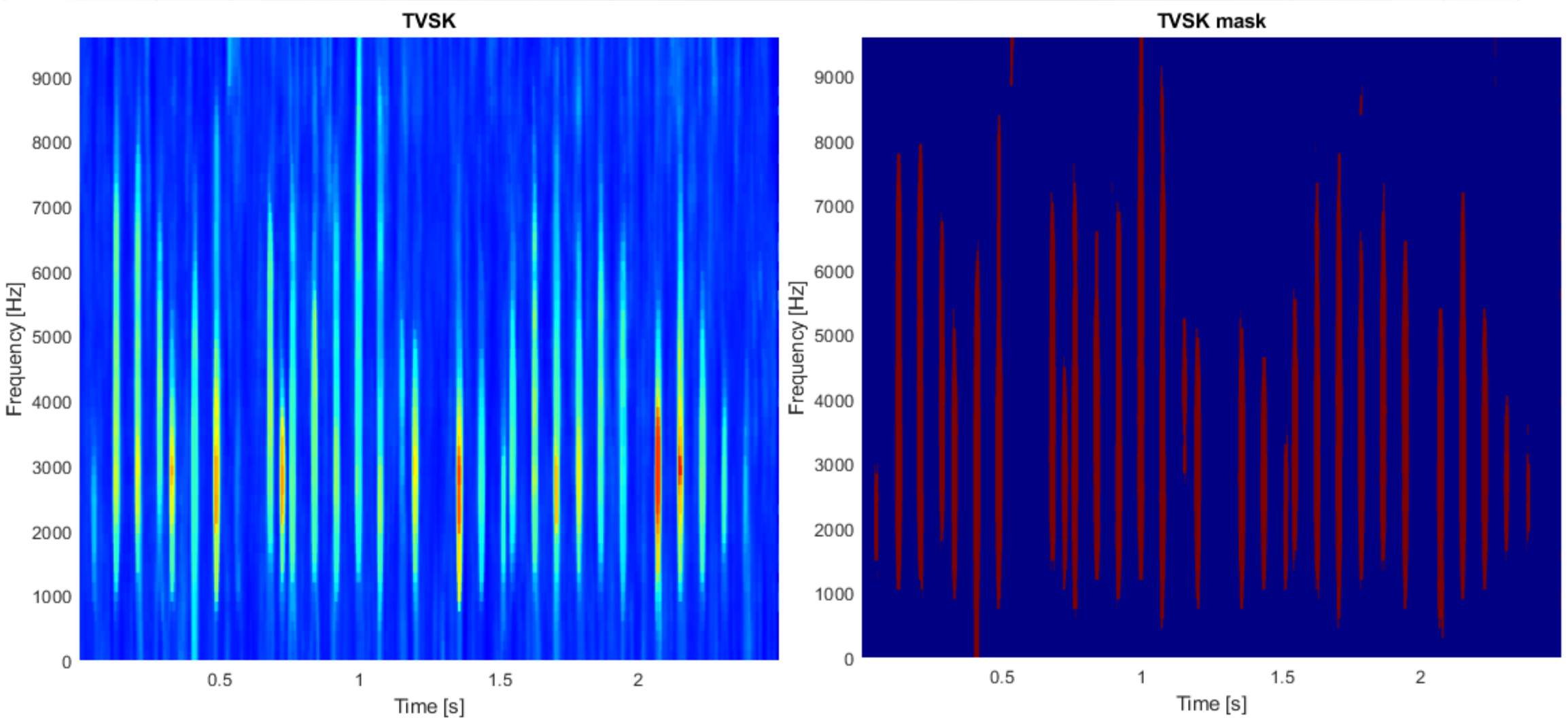
Real case: pulley bearing



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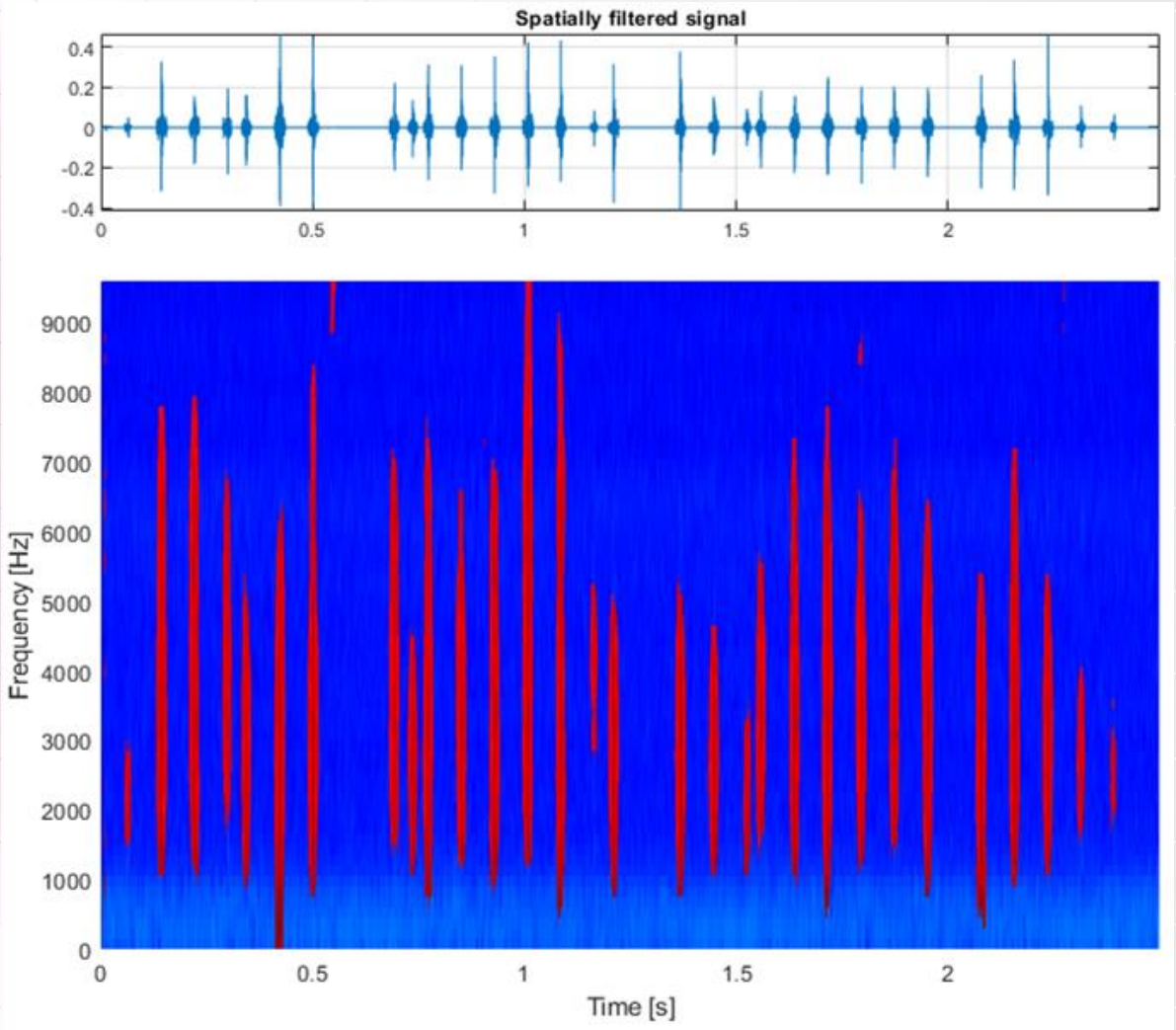
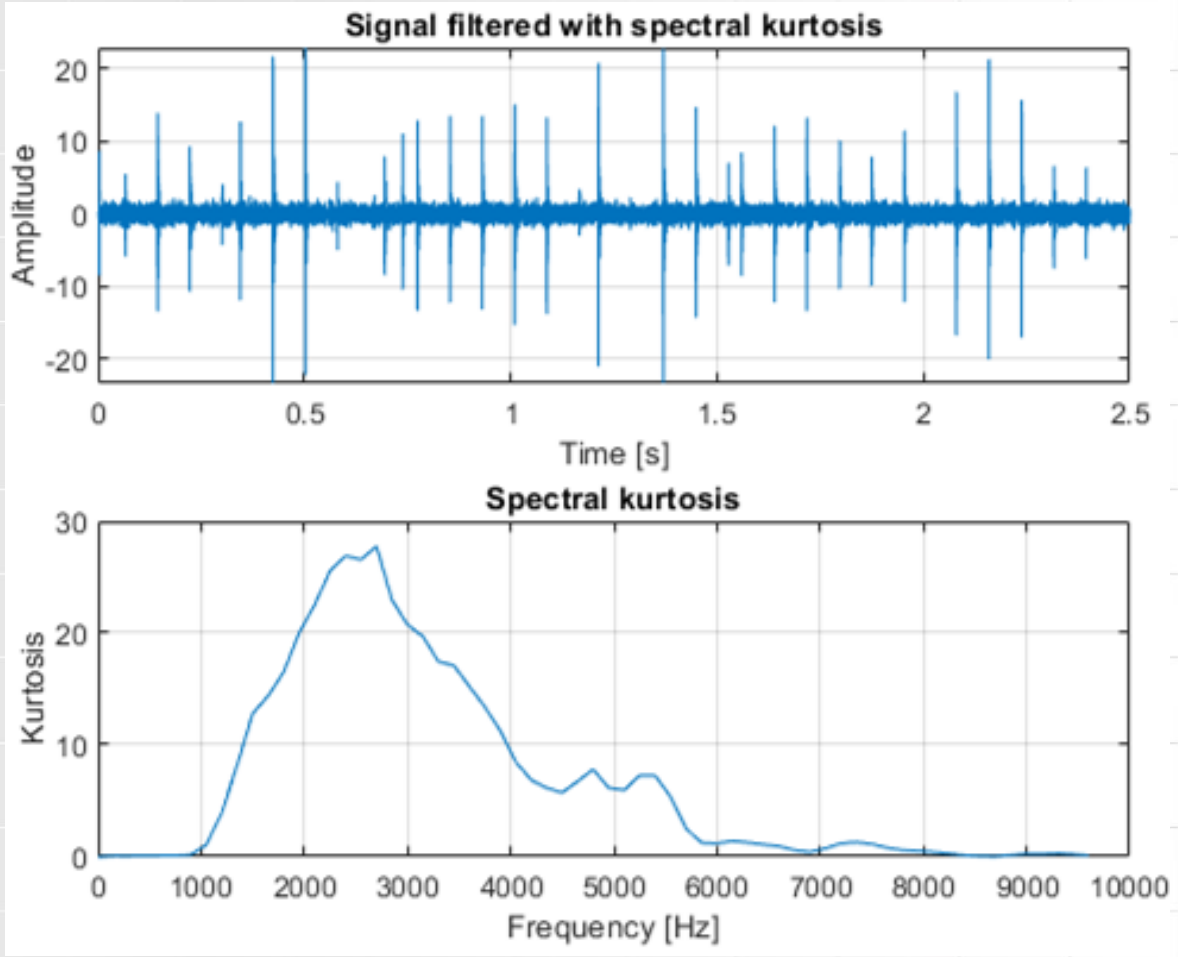
Real case: pulley bearing





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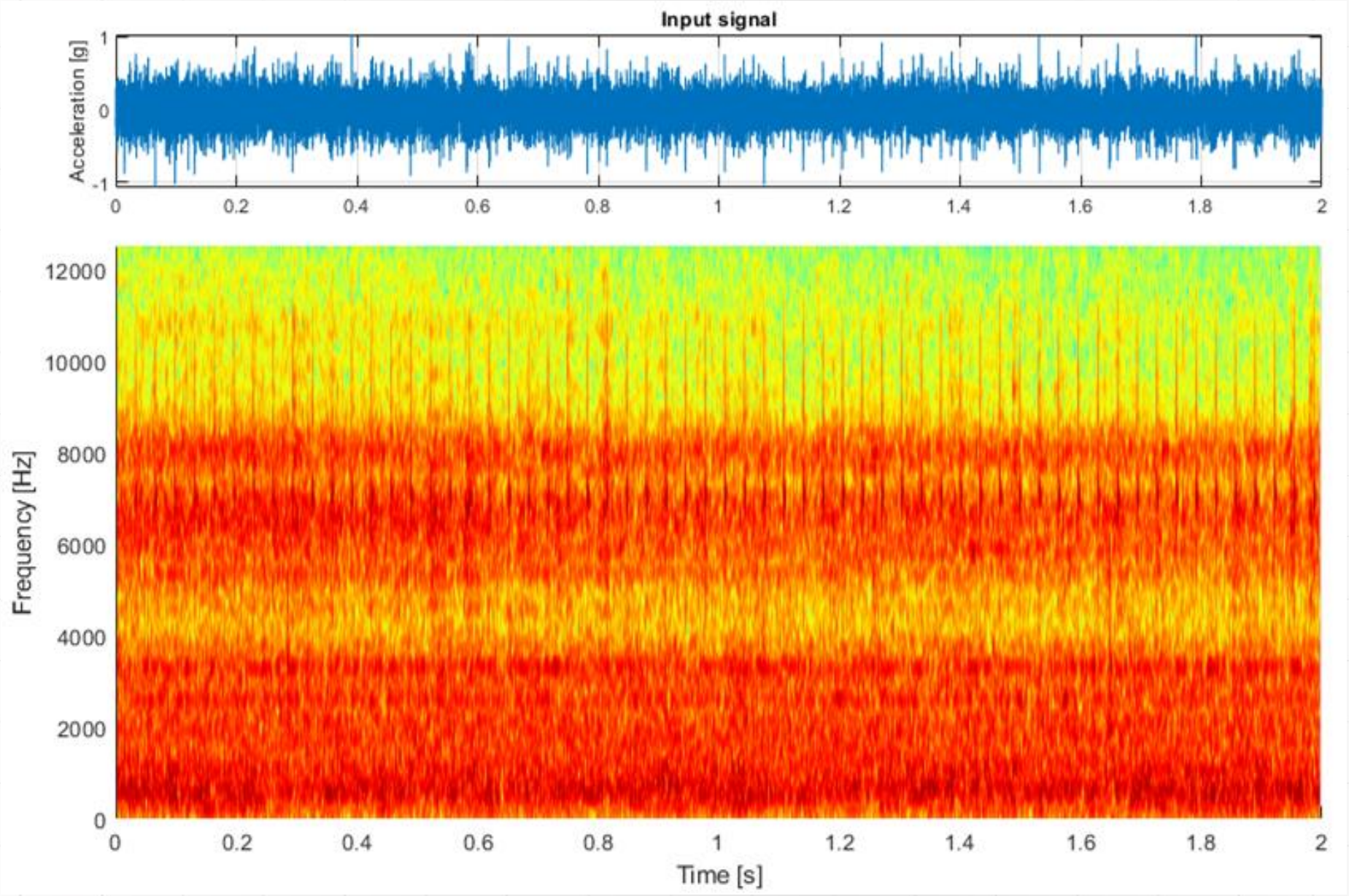
Real case: crusher bearing



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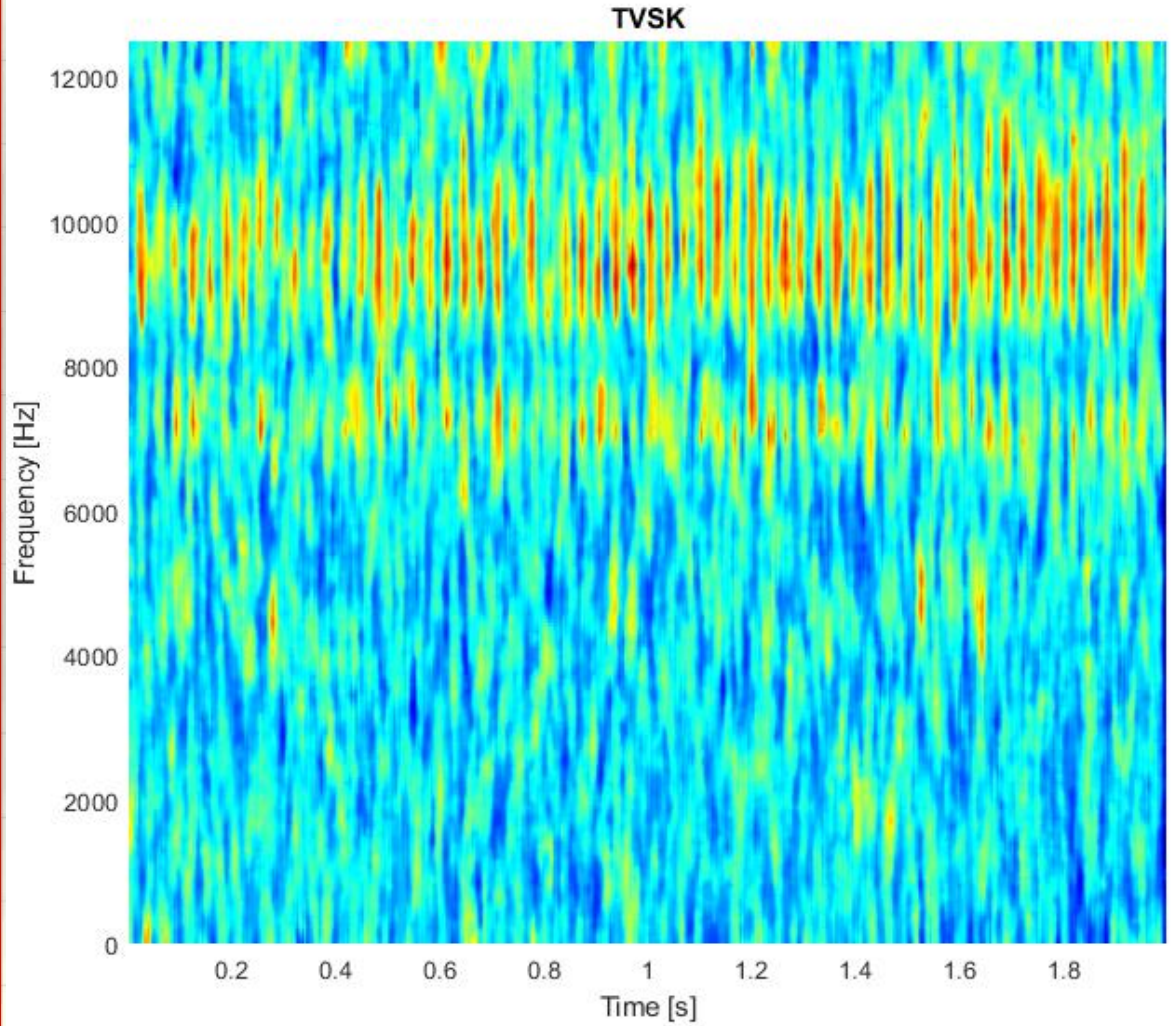
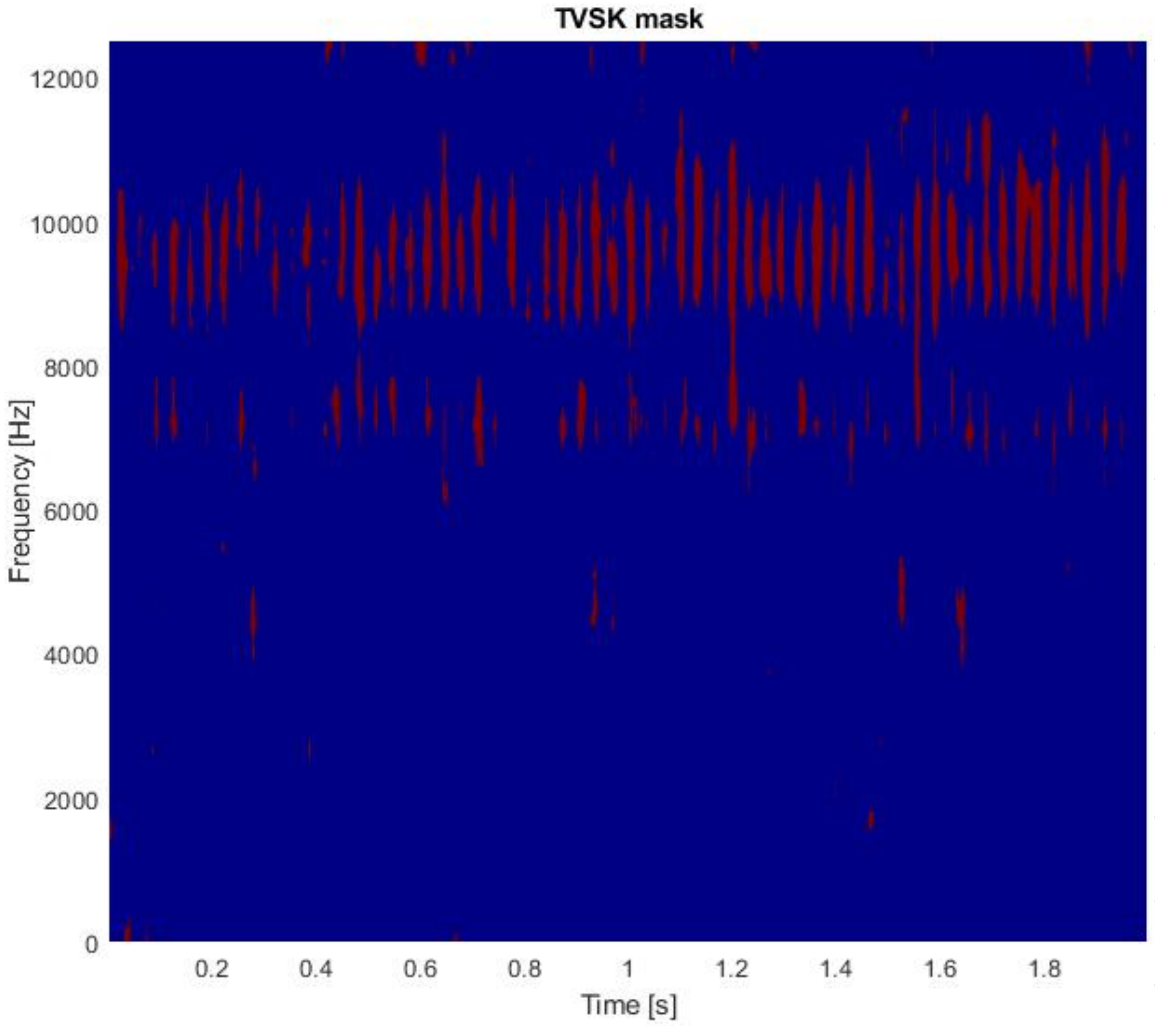
Real case: crusher bearing





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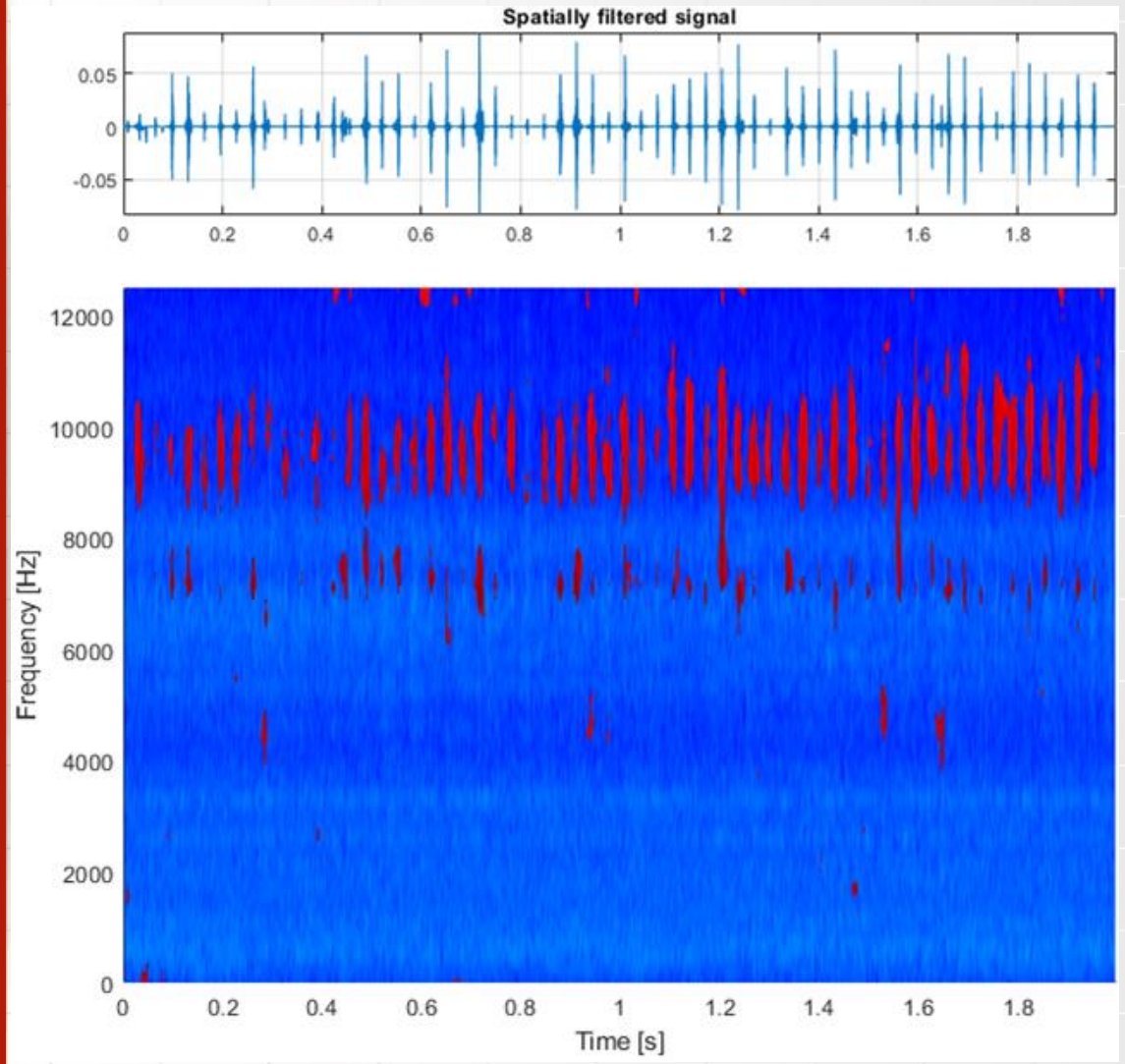
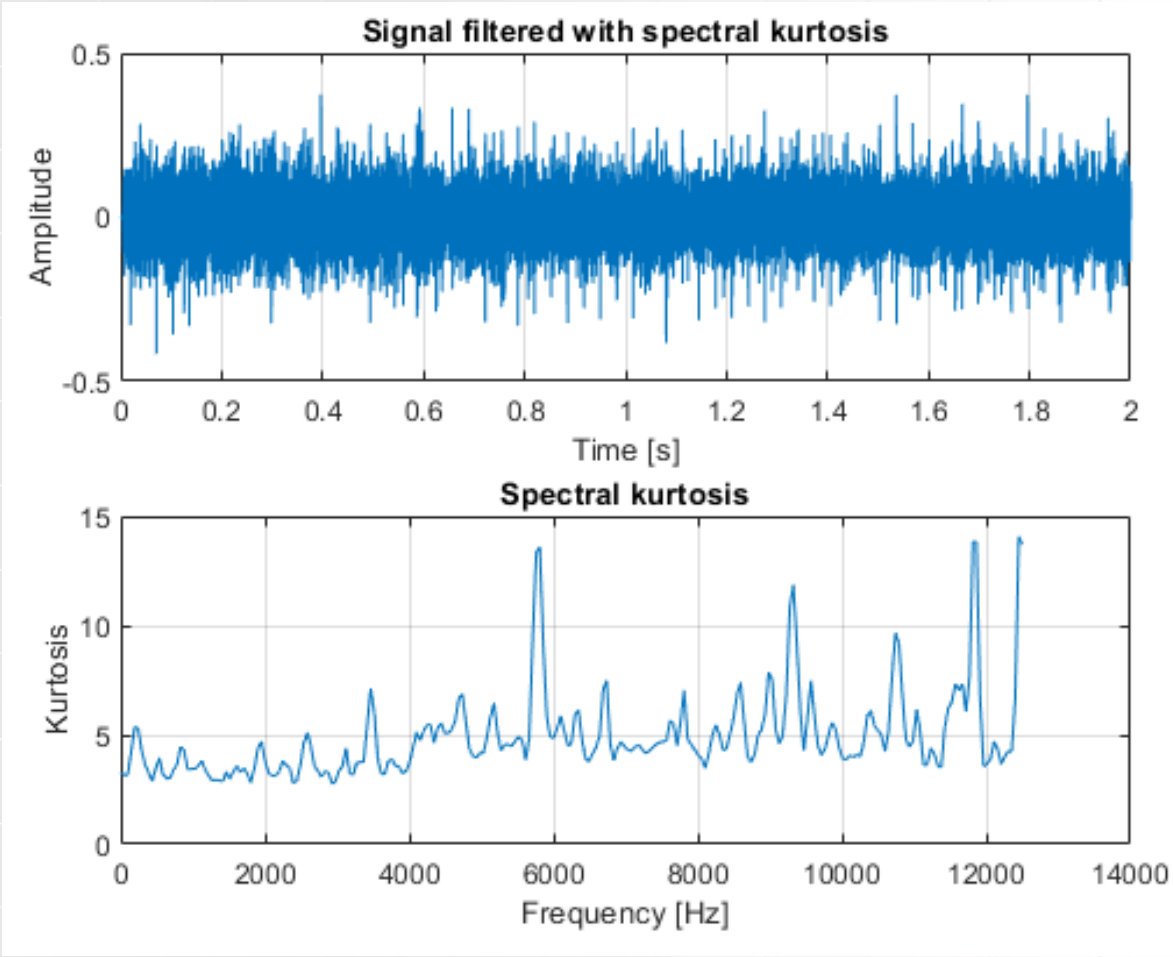
Real case: crusher bearing





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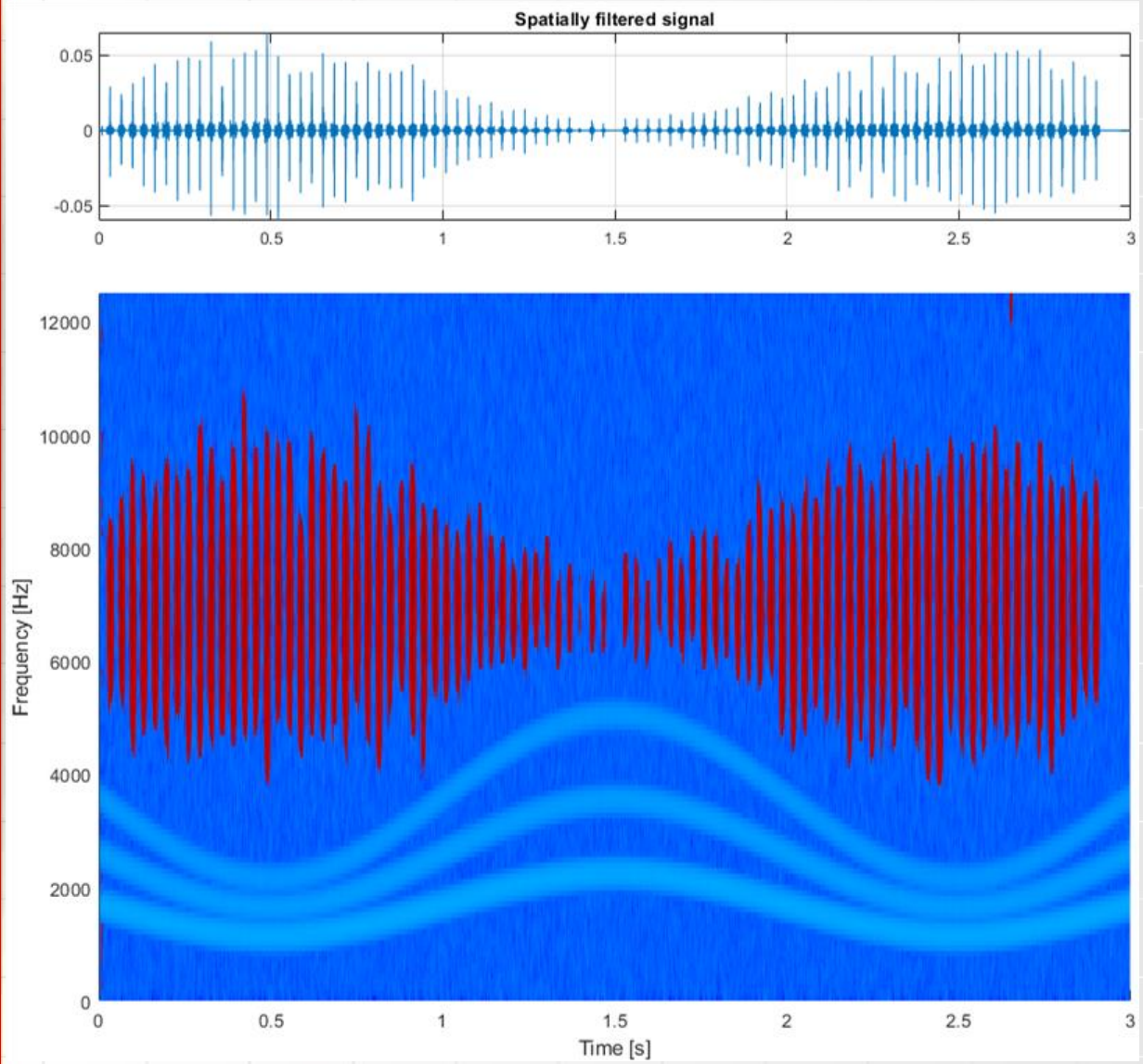
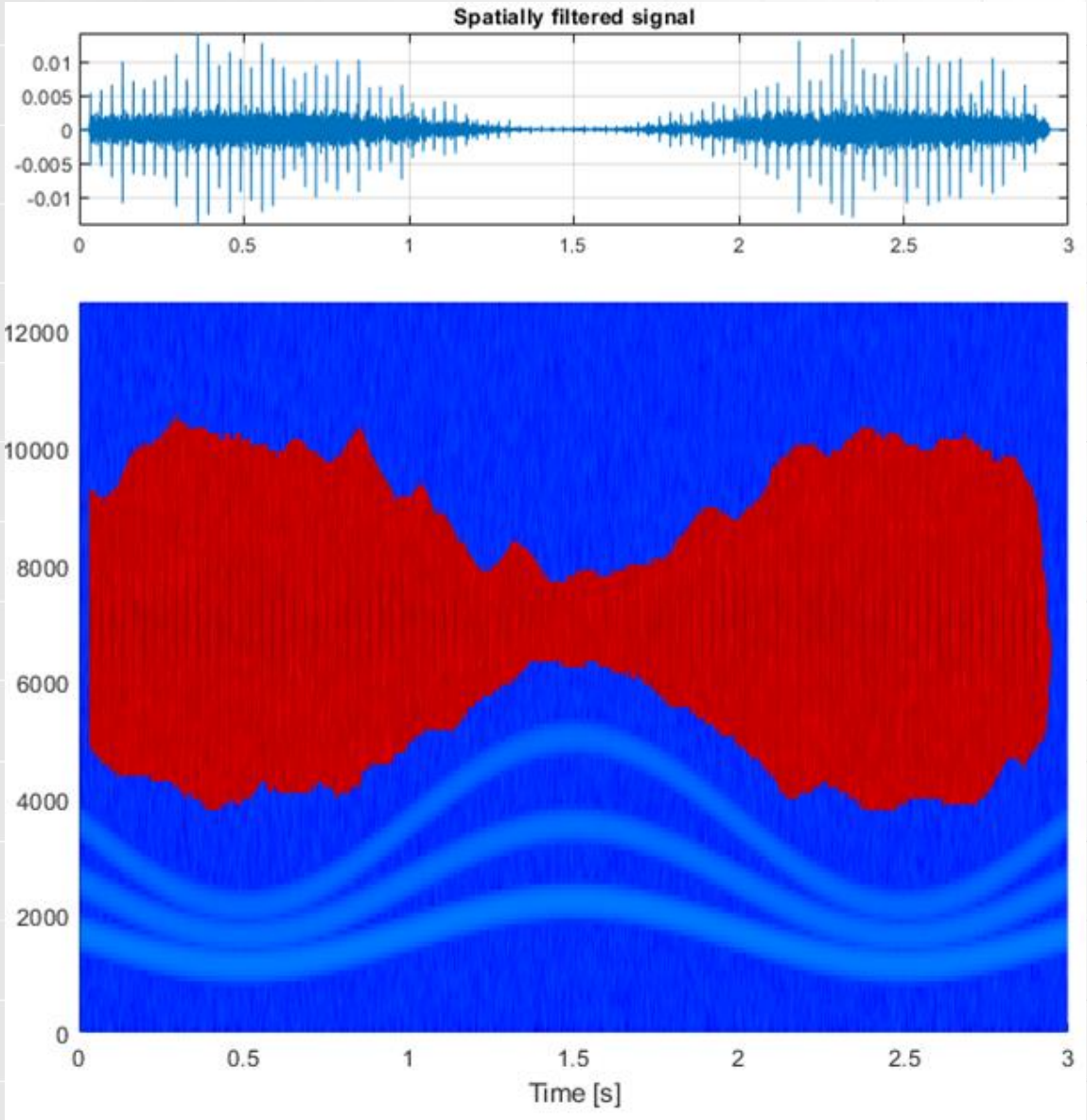
Parameterization





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Thank you for your attention

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