MULTIFRACTIONAL BROWNIAN MOTION IN VEHICLE CRASH TESTS

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Different crash tests are carried out in the car industry to measure the acceleration dependent on time with different sensors installed on characteristic positions in the vehicle. The activating of the restraint-system is implemented in the airbag-control-unit which is mounted on the middle tunnel. Airbag-algorithms are based on mechanical models of the vehicle in a crash situation and will be specifically adapted and optimized for each new car. To further improve the accident detection a more general mathematical discussion of the crash process should be conducted.

Experimental studies have shown that crash tests satisfy the model of multifractional Brownian Motion which will be introduced as a generalisation of the fractional case (including the Wiener Process). This definition is equivalent to a representation as an Itô-integral [2]:

$$B_{H_t}(t) = \frac{1}{\Gamma\left(H_t + \frac{1}{2}\right)} \left\{ \int_{-\infty}^{0} \left[(t-s)^{H_t - \frac{1}{2}} - (-s)^{H_t - \frac{1}{2}}\right] dB(s) + \int_{0}^{t} (t-s)^{H_t - \frac{1}{2}} dB(s) \right\}$$

An estimation of the significant time-dependent Hurst parameter H_t based on the ideas of Coeurjolly [1] will be developed. Its interpretation as a measure of deformation of the crash car leads to interesting results. So the Hurst index' value is important for supporting the fire-decision.

REFERENCES

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