Statistics of voltage fluctuations in resistively shunted Josephson junctions

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The intrinsic nonlinearity of Josephson junctions converts Gaussian current noise in the input into non-Gaussian voltage noise in the output. For a resistively shunted Josephson junction with white input noise we determine numerically exactly the properties of the few lowest cumulants of the voltage fluctuations, and we derive analytical expressions for these cumulants in several important limits. The statistics of the voltage fluctuations is found to be Gaussian at bias currents well above the Josephson critical current, but Poissonian at currents below the critical value. In the transition region close to the critical current the higher-order cumulants oscillate and the voltage noise is strongly non-Gaussian. For coloured input noise we determine the third cumulant of the voltage.