Sharp Norm Inequality for Bounded Submartingales and Stochastic Integrals

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Abstract:

Let $\alpha \in [0,1]$ be a fixed number and $f = (f_n)$ be a nonnegative submartingale bounded from above by 1. Assume $g = (g_n)$ is a process satisfying, with probability 1,

$$|dg_n| \le |df_n|, \quad |\mathbb{E}(dg_{n+1}|\mathcal{F}_n)| \le \alpha \mathbb{E}(df_{n+1}|\mathcal{F}_n), \qquad n = 0, 1, 2, \dots.$$

We provide a sharp bound for the first moment of the process g. A related estimate for stochastic integrals is also established.

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