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Let  $X = \{X(t) : t \in \mathbb{R}^N\}$  be a centered smooth Gaussian random field with stationary increments, we derive a formula for computing  $\mathbb{E}\{\varphi(A_u)\}$ , the mean Euler characteristic of the excursion set  $A_u = \{t \in T : X(t) \geq u\}$ , where  $T$  is a rectangle. Using Rice method, we show that for large  $u$ , the excursion probability  $\mathbb{P}\{\sup_{t \in T} X(t) \geq u\}$  can be approximated by  $\mathbb{E}\{\varphi(A_u)\}$  such that the error term is exponentially smaller than  $\mathbb{E}\{\varphi(A_u)\}$ . This work is an extension of Taylor, Takemura and Adler (2005) where the mean Euler characteristic approximation for excursion probability of smooth Gaussian field with constant variance was first obtained. (Received September 04, 2012)