

ANNALES SCIENTIFIQUES
DE L'UNIVERSITÉ DE CLERMONT-FERRAND 2
Série Mathématiques

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Annales scientifiques de l'Université de Clermont-Ferrand 2, tome 71, série *Mathématiques*, n° 20 (1982), p. 107

http://www.numdam.org/item?id=ASCFM_1982__71_20_107_0

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MARKOV PROCESSES AND THEIR LAST EXIT DISTRIBUTIONS

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In a forthcoming paper [1], we prove the following result.

Theorem. Let $(X(t), P^X)$ and $(Y(t), Q^X)$ be two (canonically defined) transient Hunt processes on E . Assume for each compact set K contained in E that $P^X(f(X_{L(K)-}); L(K)>0) = Q^X(f(Y_{L(K)-}); L(K)>0)$ for all bounded functions f on E , where $L(K)$ is the last time the process is in K . Then Y is equivalent to a time change of X by the inverse of a strictly increasing continuous additive functional.

Let (q_k) be a collection of points dense in E , and let $B_r(q_k)$ be the open ball of radius r about q_k . If we let $L(r,k)$ be the last time the process is in $B_r(q_k)$, and if we set $A(t) = \sum_j 2^{-j} \int_0^1 1_{\{0 < L(r,k) \leq t\}} dr$, then $A(t)$ is a raw additive functional of X and Y and the hypothesis of the theorem implies that $P^X \int f(X_{t-}) dA(t) = Q^X \int f(Y_{t-}) dA(t)$. Let $B(t)$ (resp. $C(t)$) denote the dual predictable projection of $A(t)$ for the process $(X(t), P^X)$ (resp. $(Y(t), Q^X)$). It is not difficult to show that $B(t)$ (resp. $C(t)$) is a strictly increasing continuous additive functional of X (resp. Y), which implies that $P^X \int f(X(t)) dB(t) = Q^X \int f(Y(t)) dC(t)$. Thus if we let $T(t)$ (resp. $S(t)$) denote the right continuous inverse of $B(t)$ (resp. $C(t)$), then $P^X \int f(X(T(t))) dt = Q^X \int f(Y(S(t))) dt$. Therefore, the resolvents of the processes $(X(T(t)), P^X)$ and $(Y(S(t)), Q^X)$ agree, so the processes have the same joint distributions. The main result follows.

This result can also be interpreted (with natural auxiliary hypotheses) as a statement in potential theory involving equilibrium measures.

- [1] J. Glover. Markov Processes with Identical Last Exit Distributions. (to appear, Zeitschrift für Wahrscheinlichkeitstheorie verw. Geb.).