

# *On Some Conjectures in Neutron Transport Theory*

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**1. Introduction and Summary.** Consider a one-dimensional homogeneous rod of fissionable material. Suppose that a neutron, entering into a collision within the rod, is replaced by two neutrons which move in opposite directions along the rod. Suppose further that neutrons, within the rod, reaching its ends, leave it permanently.

Let  $OX$ , of length  $x$ , be the rod. Suppose that  $ah + o(h)$  is the probability that a neutron enters into a collision while traversing a short distance  $h$  along the rod. Let  $p_n(x)$  and  $q_n(x)$  be the probabilities that  $n$  neutrons leave the rod at  $X$  and at  $O$  respectively within infinite time as a result of one trigger neutron incident at  $X$  at time zero. Then, if the unit of length be so chosen that  $a = 1$ , the  $p_n(x)$  and the  $q_n(x)$  are known [1], [2] to satisfy the differential equations

$$(1) \quad p'_n(x) = p_{n-1}(x) - (n+1)p_n(x) + \sum_{k=1}^n kp_k(x)p_{n-k}(x) \quad (n \geq 0, x \geq 0)$$

and

$$(2) \quad q'_n(x) = -nq_n(x) + \sum_{k=1}^n kq_k(x)p_{n-k}(x) \quad (n \geq 0, x \geq 0),$$

where

$$(3) \quad p_{-1}(x) = 0, \quad p_0(0) = 1, \quad p_n(0) = 0 \quad (n \geq 1)$$

and

$$(4)^* \quad q_0(0) = 0, \quad q_1(0) = 1, \quad q_n(0) = 0 \quad (n \geq 2).$$

The above equations are due to Bellman, Kalaba & Wing, who [2], after a

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\* This corrects a minor slip in (8.2) of [2].