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PSEUDO INVERSE FUNCTIONS OF SERVICE CURVES FOR DEADLINE CALCULATIONS

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Abstract. *This paper proposes the concept of pseudo inverse functions (PIFs) of service curves (SCs) to facilitate the deadline calculation in service curve based earliest deadline first policy (SCED). Owing to the possible non-invertible characteristic of SCs, a procedure is developed to make SCs invertible and then to get their PIFs. First, a curve instead of a function is utilized to get an inverse curve. Then, the inverse curve is mapped into a PIF. The PIF of SC is named delay curve (DC). This PIF is much like a transform, for example, Laplace Transform. The calculation is then easier by using the inverse counterpart than the original function. Actually, the DC is a new performance curve, which may extend to the other types of performance curves with usefulness for performance evaluation. Within SCED, it can be found the DC is the key factor for deadline calculation. Our proposed concept of PIF provides a way to derive the DC and the DC makes deadline calculation straightforward. In this paper, the practical procedure of PIF is developed in order to realize the calculation of DC and also theoretically verify the correctness of PIF.*

Keywords: Pseudo inverse function, Deadline calculation, Performance curves, Service curves, Delay curves, SCED, Quality of service

1. **Introduction.** For providing quality of service (QoS), the IETF has developed two service architectures for the Internet: IntServ [1] and DiffServ [2]. No matter which architecture is used, the study of QoS is still one of the most important issues in the future Internet. According to the previous research about QoS, SC seems to be the preferable way to describe it.

The definition of SC is originated by Cruz [3], and then extended by Boudec [4,5], while Cruz defined SC as a discrete time (slot-based) model and Boudec defined as continue-time. In fact, before the formal definitions of SC, Parekh has proposed the concept of it [6]. The SC defined by Cruz is a curve system provides to a user, while Parekh's SC is the output curve from the system. From the viewpoint of causation, Cruz's SC is a cause and Parekh's SC is an effect. At first, Cruz did the calculation of network delay without using the concept of SC in that approach [7]. Until 1995, the first definition of SC is proposed in [3], where SC is also named service constraint. The network calculus which is closely linked to SC is indistinctly mentioned in [7] and then is definitely used by Boudec [4,5].