DYNAMIC RATE COUPLED PROCESSORS WITH ABANDONMENT: APPROXIMATION AND COMPUTATION

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We consider a two dimensional time varying tandem queue with coupled processors. We assume that jobs arrive to the first station as a non-homogeneous Poisson process. When each queue is non-empty, jobs are processed separately like an ordinary tandem queue. However, if one of the processors is empty, then the total service capacity is given to the other processor. This problem has been analyzed in the constant rate case by leveraging Riemann Hilbert theory and two dimensional generating functions. Since we are considering time varying arrival rates, generating functions cannot be used. Thus, instead of the generating functions we choose to exploit the functional Kolmogorov forward equations for the two dimensional queueing process. By using the functional forward equations, it is necessary to approximate the queueing distribution in order to compute the relevant expectations and covariance terms for the mean and variance. To this end, we expand our two dimensional Markovian queueing process in terms of a two dimensional Hermite polynomial sequence and use this expansion as a surrogate distribution. Finally, we are able to show that we can estimate probabilistic quantities of the two dimensional queueing process such as the mean, variance, and probability that each queue is empty with good accuracy.