

## Abstract

In caching system, we prefer to design a coded caching scheme with the rate  $R$  and the packet number  $F$  as small as possible since the efficiency of transmission in the peak traffic times increases with the decreasing of  $R$  and the realizing complexity increases with the increasing of  $F$ . In this paper, we first introduce a framework for constructing coded caching schemes, which can represent almost all of the previously known schemes. Based on this framework, we obtain a new scheme, which generalizes the schemes constructed by Shangguan et al. (IEEE Trans. Inf. Theory, 64, 5755-5766, 2018) and Yan et al. (IEEE Commun. Lett., 22, 236-239, 2018) and has better performance compared with these two schemes since it has advantages on the user number, the coded gains and the flexible memory size. Then the relationships between a coded caching scheme and orthogonal array, covering array are derived respectively. Consequently a tight lower bound on the packet number  $F$  is derived since the packet number of the schemes constructed by Yan et al. (IEEE Trans. Inf. Theory 63, 5821-5833, 2017) gets this lower bound. Finally based on orthogonal array, we construct a new scheme which has the same user number, memory size and transmission rate as the scheme constructed by

Shangguan et al. (IEEE Trans. Inf. Theory, 64, 5755-5766, 2018)  
but has smaller packet number.