1011-15-189 **Chi Kwong Li** (ckli@math.wm.edu), Department of Mathematics, College of William and Mary, Williamsburg, VA 23187-8795, **Yiu Tung Poon***, Department of Mathematics, Iowa State University, Ames, IA 50011, and **Nung Sing Sze** (nungsingsze@graduate.hku.hk), Department of Mathematics, The University of Hong Kong, Hong Kong, Hong Kong. *Linear maps transforming the higher numerical ranges.*

Let $k \in \{1, \ldots, n\}$. The k-numerical range of $A \in M_n$ is the set

$$W_k(A) = \{(\operatorname{tr} X^*AX)/k : X \text{ is } n \times k,\ X^*X = I_k\},$$

and the k-numerical radius of A is the quantity

$$w_k(A) = \max\{|z| : z \in W_k(A)\}.$$

Suppose $k > 1$, $k' \in \{1, \ldots, n'\}$ and $n' < C(n,k)\min\{k', n'-k'\}$. It is shown that there is a linear map $\phi : M_n \to M_{n'}$ satisfying $W_{k'}(\phi(A)) = W_k(A)$ for all $A \in M_n$ if and only if $n'/n = k'/k$ or $n'/n = k'/(n-k)$ is a positive integer. Moreover, if such a linear map ϕ exists, then there are unitary matrix $U \in M_{n'}$ and nonnegative integers p, q with $p + q = n'/n$ such that ϕ has the form

$$A \mapsto U^*[\underbrace{A \oplus \cdots \oplus A}_{p} \oplus \underbrace{A^t \oplus \cdots \oplus A^t}_{q}]U$$

or

$$A \mapsto U^*[\underbrace{\psi(A) \oplus \cdots \oplus \psi(A)}_{p} \oplus \underbrace{\psi(A)^t \oplus \cdots \oplus \psi(A)^t}_{q}]U,$$

where $\psi : M_n \to M_n$ has the form $A \mapsto [(\operatorname{tr} A)I_n - (n-k)A]/k$. Linear maps $\widetilde{\phi} : M_n \to M_{n'}$ satisfying $w_{k'}(\widetilde{\phi}(A)) = w_k(A)$ for all $A \in M_n$ are also studied. Furthermore, results are extended to triangular matrices. (Received August 26, 2005)