# Asymptotic behaviors of Mostow's decomposition

Tin-Yau Tam
Department Chair & Foundation Professor
Seneca C. and Mary B. Weeks Chair in Mathematics
Department of Mathematics and Statistics
University of Nevada, Reno

Let $\mathbb{P}_n$ denote the $n \times n$ complex positive definite matrices. The Mostow decomposition (1955) asserts that that each $A \in \mathbb{P}_n$ can be factored as $A = e^S e^{iK} e^S$, where $S$ is a real symmetric matrix, and $K$ a real skew-symmetric matrix. With these conditions $S$ and $K$ are uniquely determined. The original proof of Mostow is geometric while Bhatia (2013) provided a matrix-theoretic proof with a parallel version. The Mostow decomposition is closely related to the geometric mean (introduced by Pusz and Woronowicz in 1975) and spectral geometric mean (introduced by Fiedler and Pták in 1997).

For the matrix powers $A^p$ ($p \geq 0$), we have

$$A^p = e^{S_p} e^{iK_p} e^{S_p},$$

where $S_p$ and $K_p$ are real symmetric and skew-symmetric matrices. In this talk, we will discuss the roles of the geometric and spectral geometric mean in the Mostow decomposition along with the asymptotic behaviors of the matrix functions $\left\{\frac{S_p}{p}\right\}$ and $\left\{\frac{iK_p}{p}\right\}$. We will also present extensions of these results in the context of symmetric spaces.

This is a joint work with **Huajun Huang** (Auburn University) and **Xiang Xiang Wang** (Michigan State University).