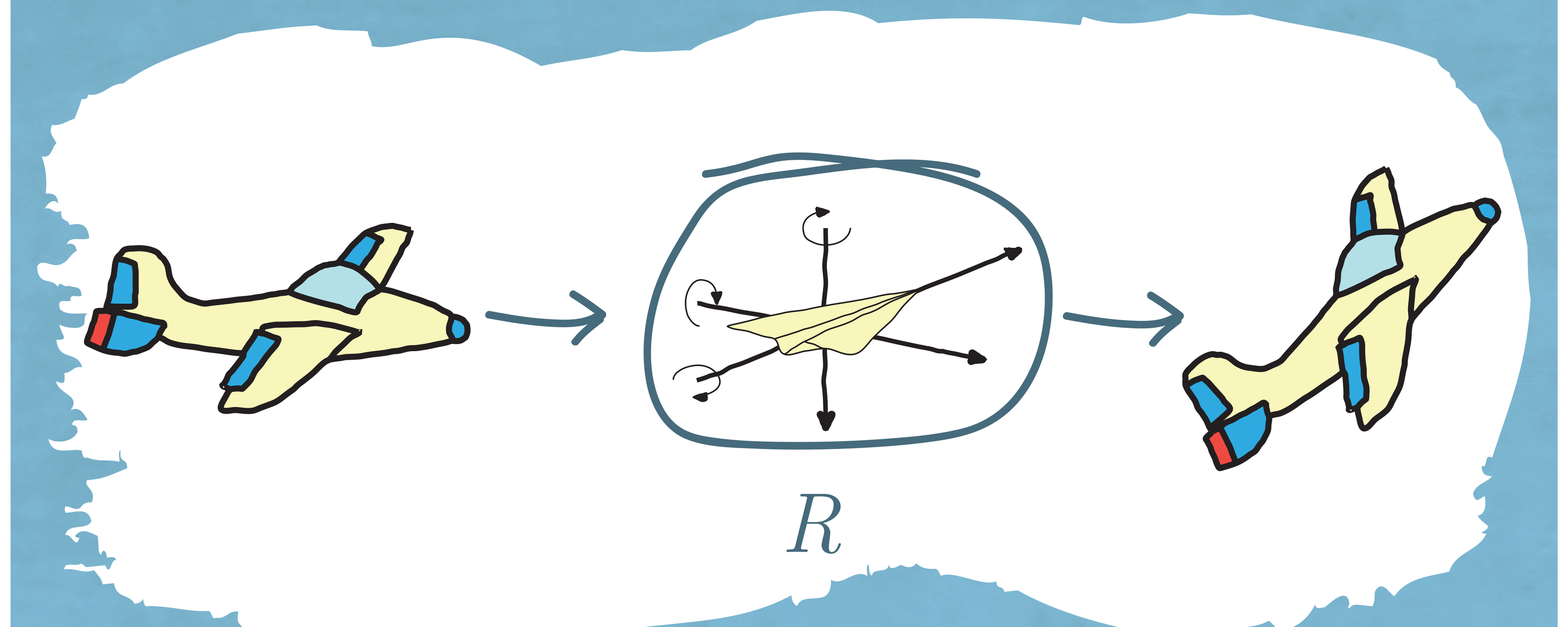
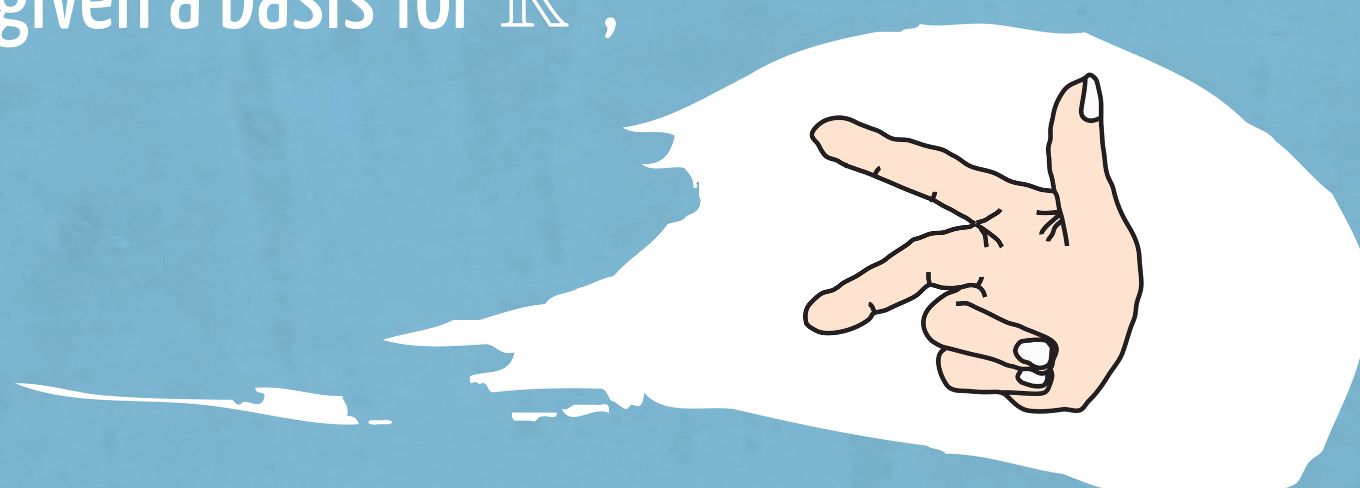
Operator Representations in Geometry Processing

Omri Azencot
Advisor: Asst. Prof. Miri Ben-Chen
Technion - Israel Institute of Technology
azencot@cs.technion.ac.il

global rotation $R:\mathbb{R}^3\to\mathbb{R}^3$

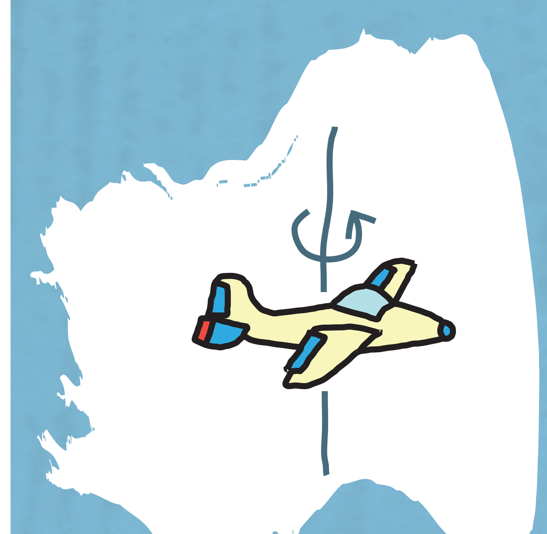


given a basis for $\mathbb{R}^3$,

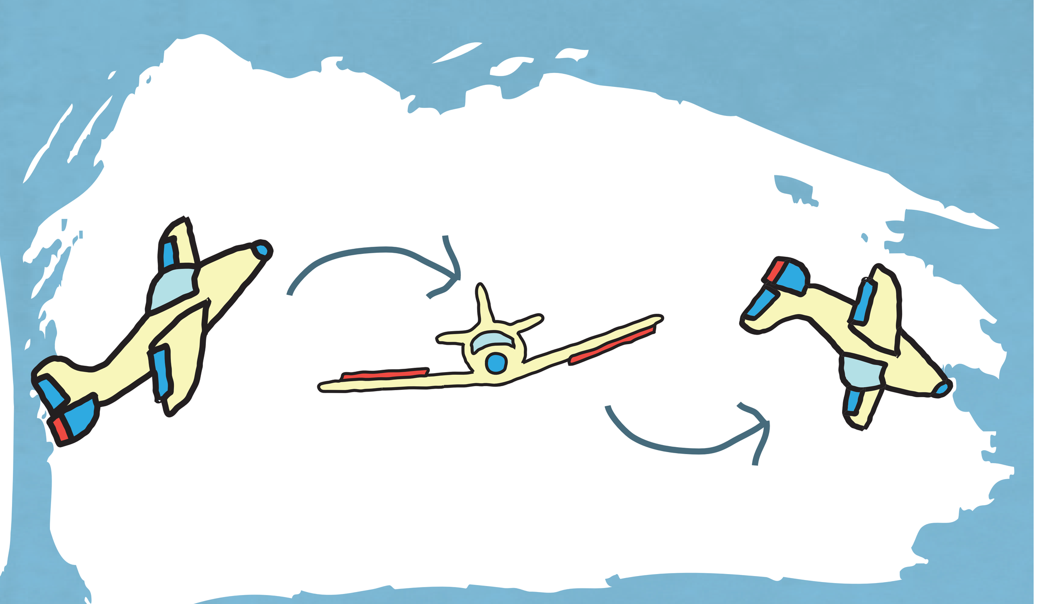


then R is simply a 3×3 matrix (operator)!

manipulating R with linear algebra tools yields:



axis of rotation



sequence of rotations

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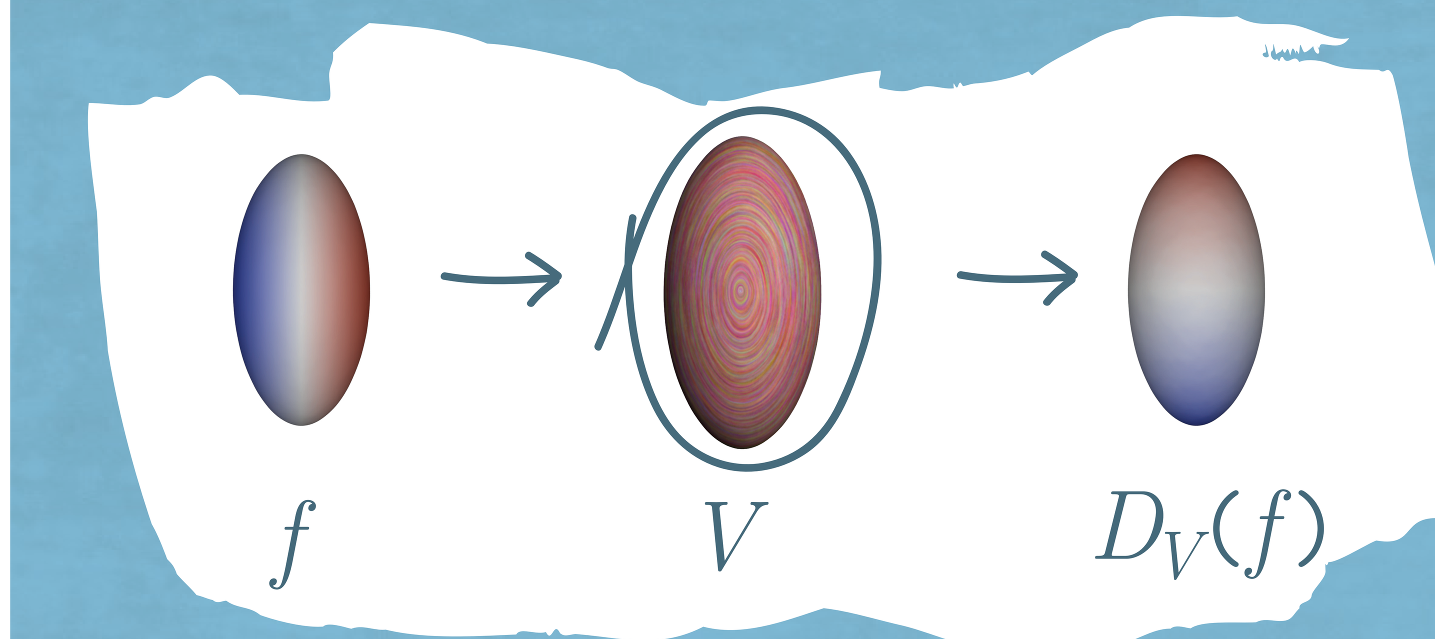
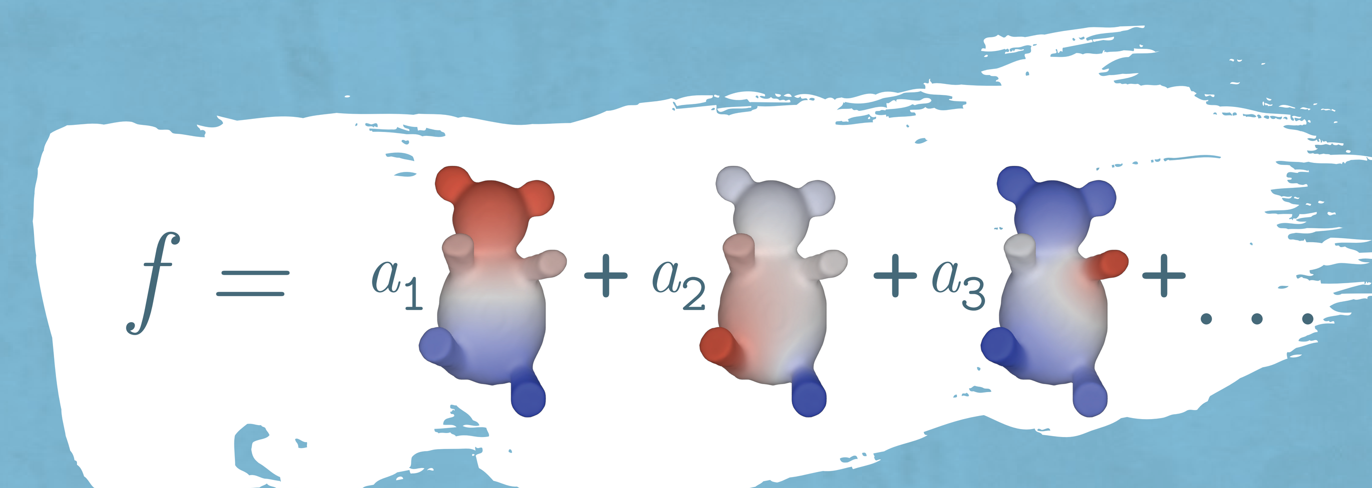
directional derivative of a function

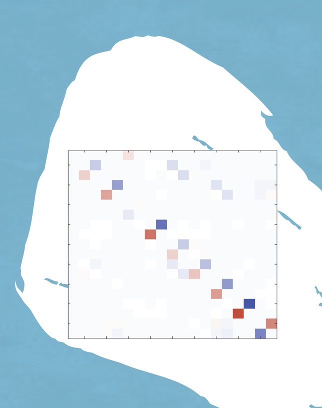
$D_V: L^2(M)\to L^2(M)$



with a suitable choice of basis



and D_V becomes a $k\times k$ operator:



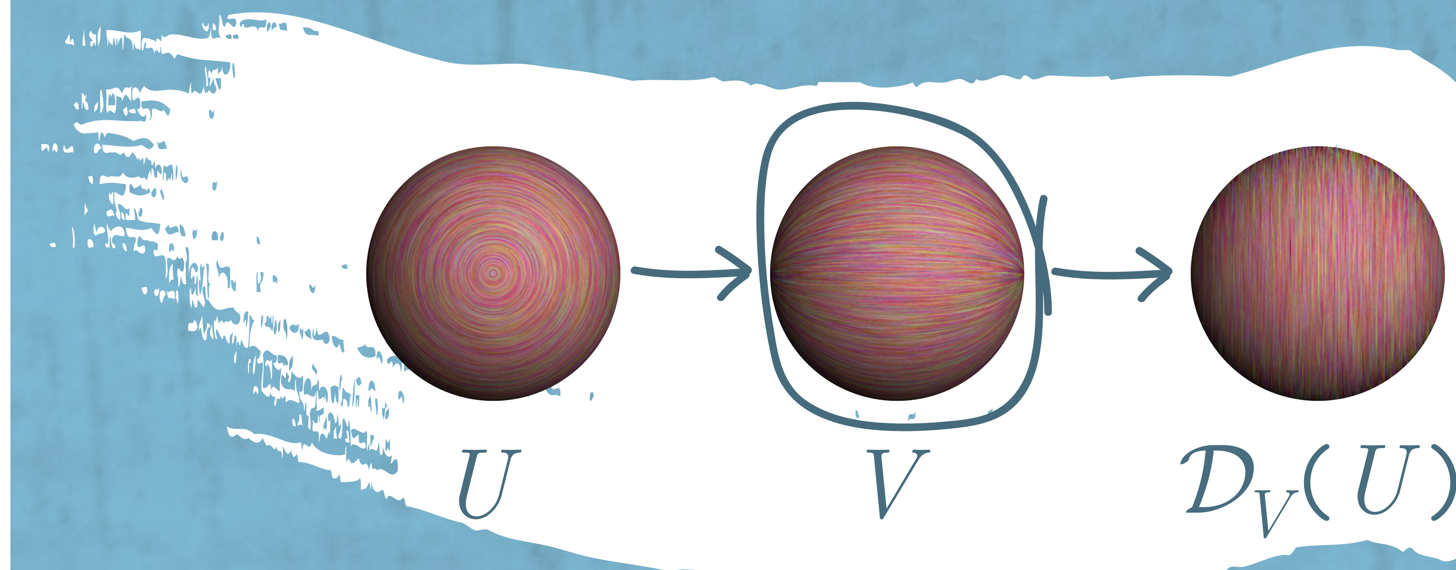
then, with linear algebra machinery we get:

flow of V applied to f

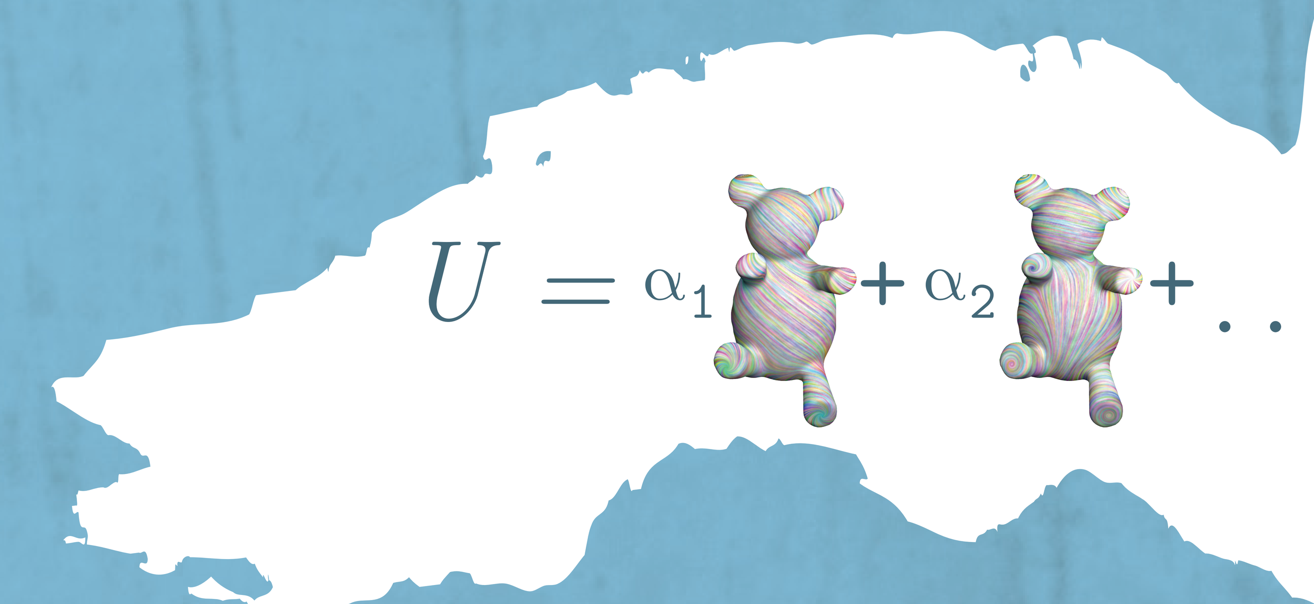
symmetrization of f

directional derivative of a vector field

$\mathcal{D}_V: L^2_\chi(M)\to L^2_\chi(M)$

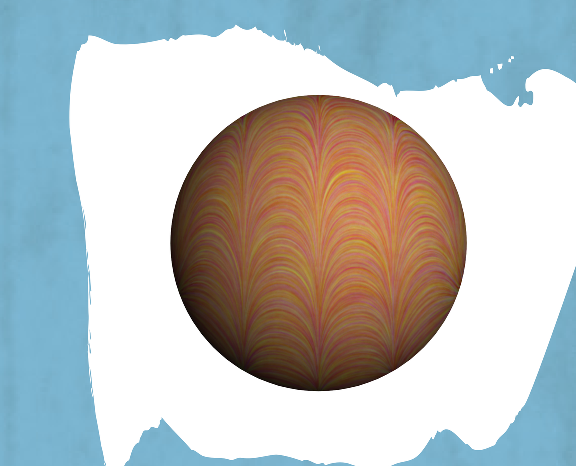


we take a smooth basis, thus



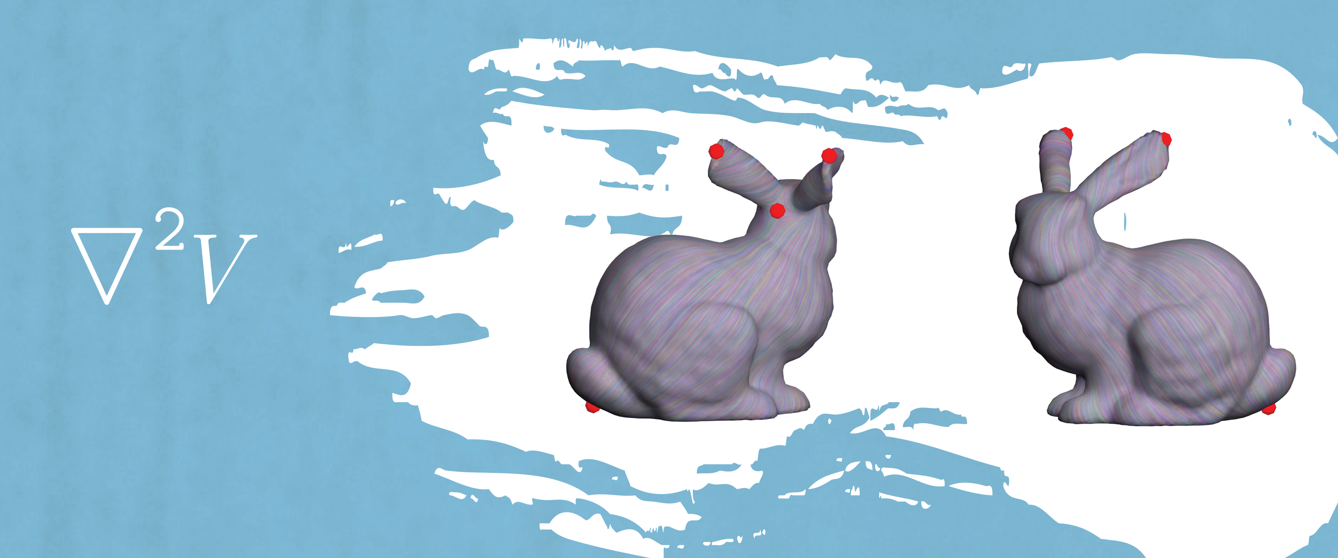
analysis of $\mathcal{D}_V$ leads to geometric constructs:

geodesic vector field



parallel transport along V

can be easily extended!



smooth vector field

you can also try it ...
what is your favorite geometric operator?