

Power method

Federica Filippini, Danilo Ardagna, Marco Lattuada

Politecnico di Milano

federica.filippini@polimi.it

danilo.ardagna@polimi.it

Content

The power method is a numerical technique to approximate the dominant eigenvector of a square matrix, that is whose eigenvalue has the highest absolute value

Starting from an initial guess for the eigenvector, compute repeatedly the matrix-vector product; the sequence obtained will converge to the dominant eigenvector

Matrix-vector product is an expensive operation, but can be easily parallelized with MPI

Content

$$\mathbf{x}_1 = A\mathbf{x}_0$$

$$\mathbf{x}_2 = A\mathbf{x}_1 = A^2\mathbf{x}_0$$

$$\mathbf{x}_3 = A\mathbf{x}_2 = A^3\mathbf{x}_0$$

$$\vdots$$

$$\mathbf{x}_k = A\mathbf{x}_{k-1} = A^k\mathbf{x}_0$$

Goals

- Write a parallel program to perform the power method
- Matrices are represented as DenseMatrix objects, whose values are stored by rows in a vector
- The initial code already contains the matrix class along with some useful methods. Notably:
 - operator * performs the serial product and is already implemented
 - data() returns a pointer to the data elements
- The main function performs reading from input matrices and output printing, while it lacks the power method section
- **Assume matrix dimensions are always multiples of the communicator size!**