1. INTRODUCTION

- **FBR cycle system**
  - Low-decontaminated MA fuel is to be used.
- **Sphere-pac fuel manufacturing**
  - MOX fuel is to be formed to be spherical. (About 10µm~1000µm)
  - Two kind of particle of different diameter are blended and packed.
- **Challenging of sphere-pac fuel**
  - For achieving \( \text{HIGH and UNIFORM} \) packing density
  - 1. Comprehending the behavior of particles in a vibrating tube
  - 2. Estimating the most effective value

We apply a Distinct Element Method (DEM) to numerical simulation of the vibration-based packing process.

2. COMPUTATIONAL METHOD

- **Two-Dimensional Distinct Element Method**
  - To calculate a contact force...
  - Virtual spring and Virtual dashpot are assumed.
  - A repulsion force and A friction force
  - Contact Force can be expressed

- **Pseudo Three-Dimensional Model**
  - Particles of the same diameter
    - 3-D closest packed structure ≠ 2-D closest packed structure
    - Equivalent diameter \( r' \) is defined

3. NUMERICAL SIMULATION

- **Two-dimensional simulation**
  - Vibration added
    - No infiltration of particles due to 2-D simulation

- **Pseudo three-dimensional simulation**
  - Vibration added
    - Realistic analysis of fuel packing phenomenon
    - Enhancement of the infiltration due to external vibration

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**NOMENCLATURE**
- \( F_i \): contact force
- \( K_i \): a stiffness coefficient
- \( \eta_i \): a damping coefficient
- \( u_i \): relative displacement
- \( \psi_i \): displacement of relative rotation
- \( m_i \): mass of particles
- \( I_i \): inertia moment
- \( n_i \): the number of contact particles

**Equation of motion**
- Newton's equation of motion

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<th>PARTICLES</th>
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