1. Background: Mechanical impedance measurement

Continuous / High throughput sensing of Cell Mechanical Parameters

2. On-chip cellular force measurement

<table>
<thead>
<tr>
<th>Passive type</th>
<th>Active type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low throughput</td>
<td>High throughput</td>
</tr>
<tr>
<td>Relative sensing</td>
<td>Absolute sensing</td>
</tr>
</tbody>
</table>

Fixed measurement point

- Geometrically-constrained microchannel
- 3DOF Microtool
- Force sensor

Applying force

| Parameters were estimated from CCD image |

3. OCIAN: On-Chip Impedance ANalyzer

4. Displacement reduction mechanism

Problem: Dead band

MNT doesn’t move despite the displacement of the stage

Dead-band is reduced by displacement reduction mechanism

This mechanism utilizes the serially-connected springs with different stiffness

5. Experimental results

(a) Fabrication of cover layer
(b) Fabrication of device layer
(c) Fabrication of holder layer

6. Conclusions

Robochip, which has microfluidic chip integrated with robotic sensing unit, was proposed as a disposable part of OCIA for the cellular force measurement. The tunable wall with the displacement reduction mechanism, which is the serially-connected springs with different stiffness, was actuated in non-contact by the magnetic force. We succeeded in nanometric order tuning of the tunable wall width. On-chip cellular force measurement of flowing cells was succeeded by in-situ and pre-tuning of the wall.

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Reference

Shinya Sakuma, Fumihito Arai, "可変マイクロチャネルを用いた細胞の力計測", 25th CHEMINAS