Experiment with one rotor using two rotating bearing discs of different sizes.

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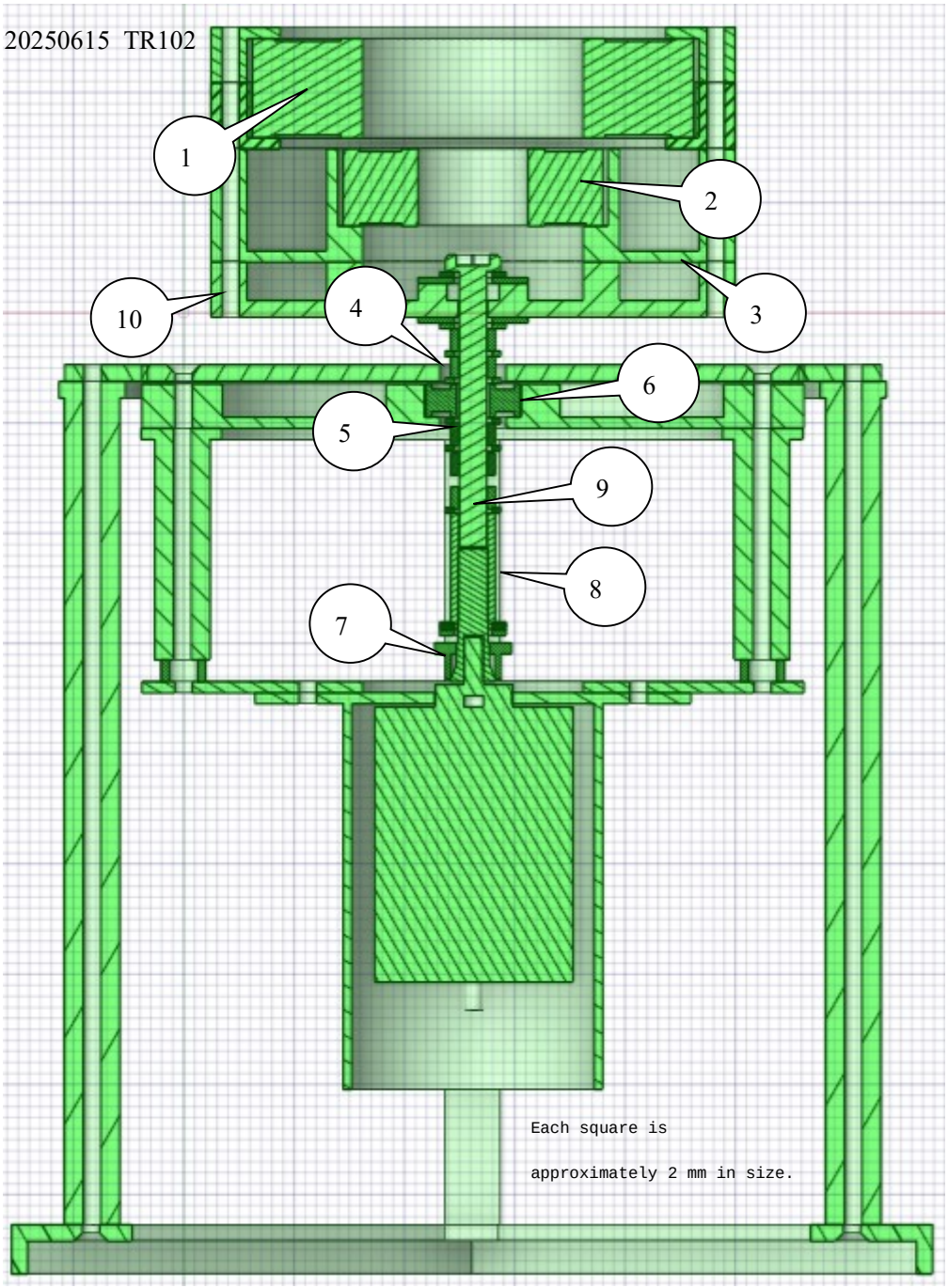
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In the previous experiment, we confirmed that the smaller ring was attracted to the center of the larger of two rotating rings of different sizes. As an application of this, I thought about trying a hybrid system using a propeller, but it seemed more natural to conduct an experiment to observe upward thrust by making the ring larger and heavier. I had some large bearings (outer diameter 80mm) that I had acquired previously, so I decided to use them as a donut-shaped disc for the experiment.

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■Structure



① NTN6208ZZ ball bearing, outer diameter 80mm, actual mass 366.5[g], iron-based ferromagnetic material (internal structure of 3D drawing omitted)

② NTN6204ZZ ball bearing, outer diameter 47mm, actual mass 103.0[g], iron-based ferromagnetic material (internal structure of 3D drawing omitted)

③ 3D printed with PLA material at a 50% infill rate

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④ The load from above is absorbed by the bearing in ⑥, reducing the load on the motor's rotating shaft.

⑤ The upward force from below is absorbed by the bearing in ⑥, reducing the load on the collet-type connection to the motor.

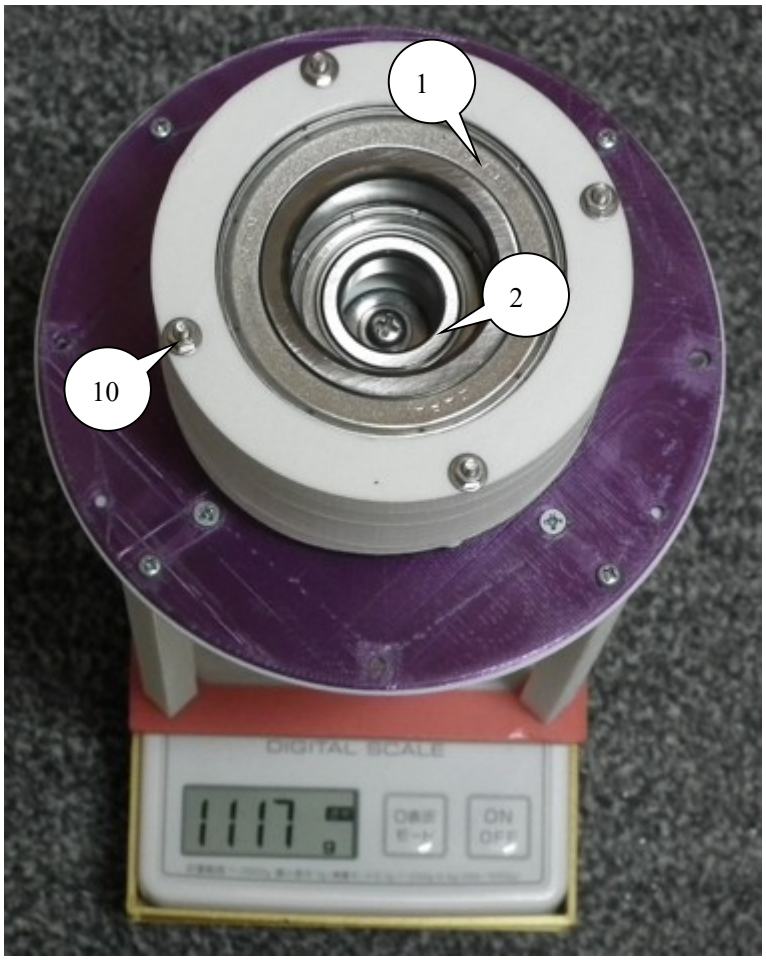
⑥ Bearing with an outer diameter of 17mm, an inner diameter of 6mm, and a thickness of 6mm. Iron-based ferromagnetic material.

⑦ Collet-type fitting for direct connection to the motor. Made of aluminum (non-magnetic material).

⑧ High nut with a height of 20mm. Made of brass (non-magnetic material).

⑨ Stainless steel bolt (almost non-magnetic material) with a diameter of 5mm and a length of 50mm (threaded part). It was made 10mm longer than last time to prevent the nut from loosening.

⑩ Although not shown in this diagram, it is secured with four stainless steel bolts (almost non-magnetic material) with a diameter of 3mm and a length of 60mm.



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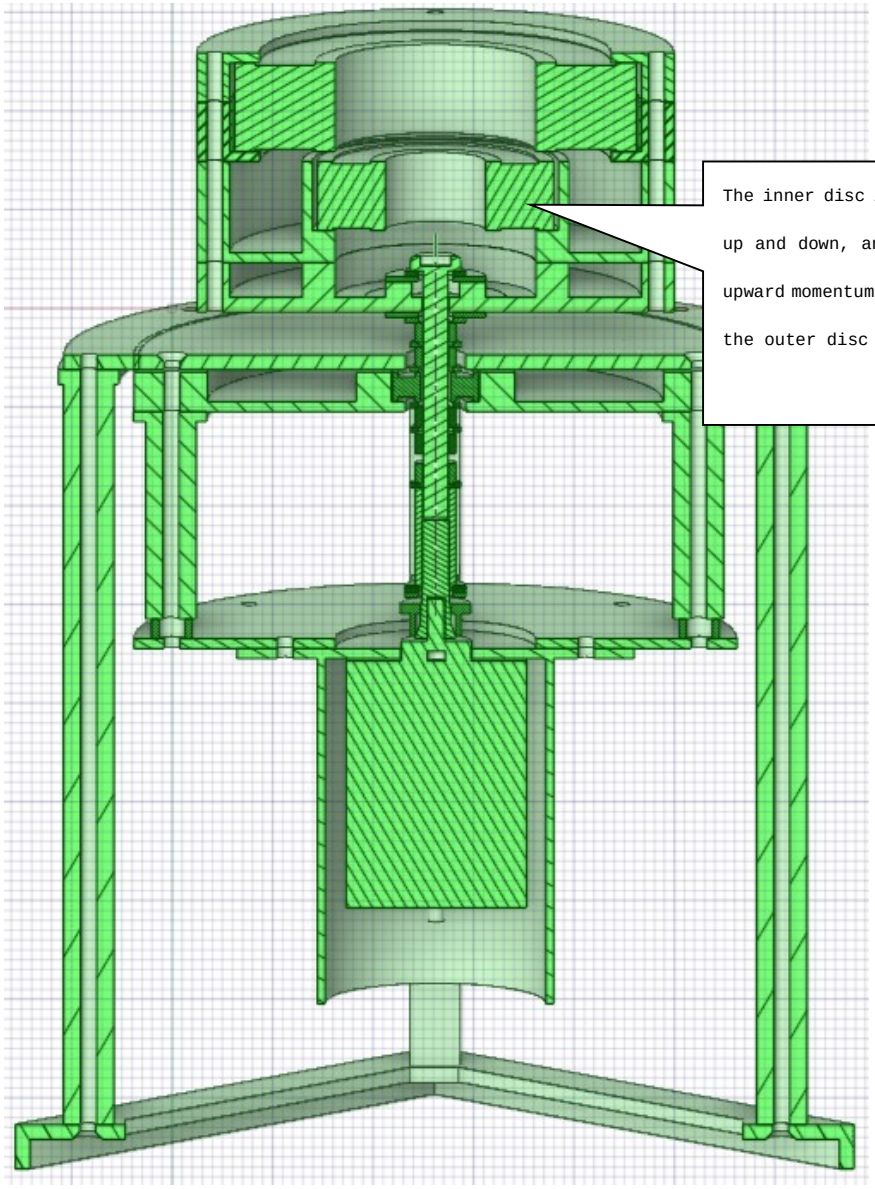


366.5g and 103.0g (about three times heavier than last time)





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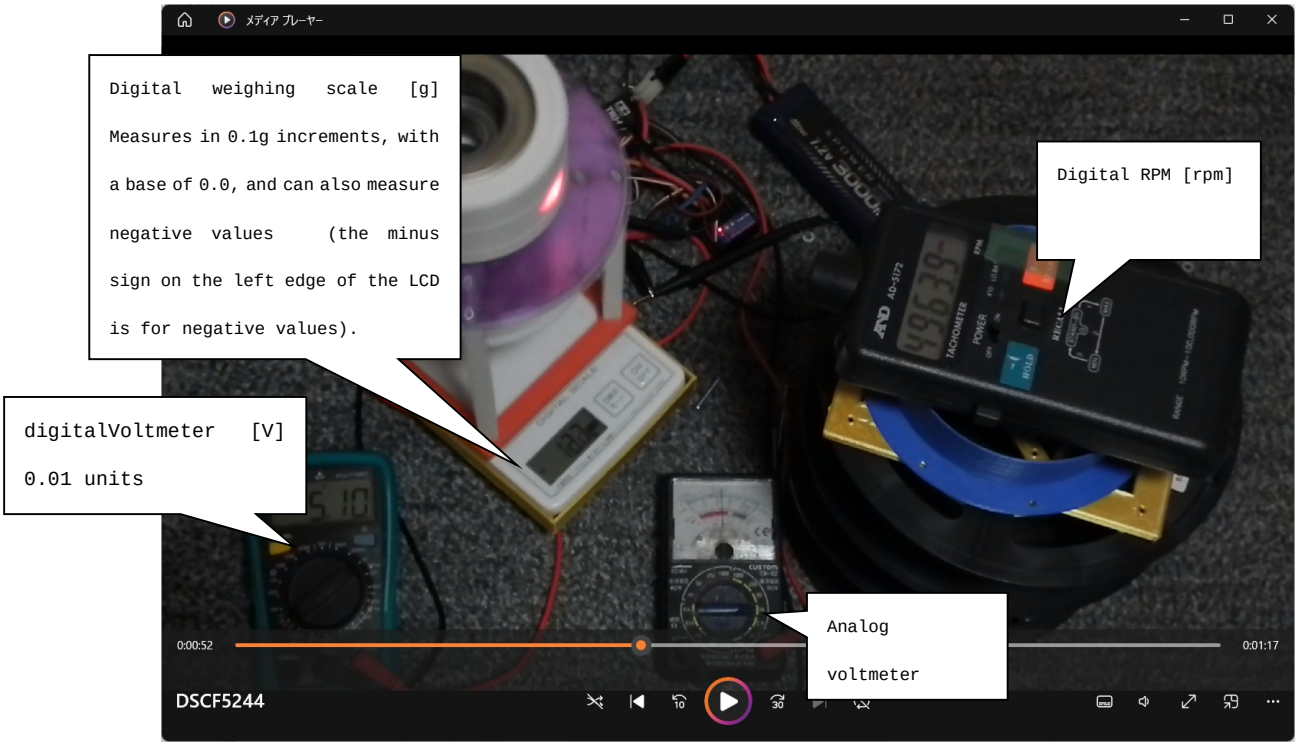


I used the same standard 540-class motor as last time. (This photo is reused from last time.)



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■ Measurement experiment results of upward thrust on one rotor of two rotating bearing discs of different sizes



Measured values (numerical values obtained from the recorded video [TR102/DSCF5244.mp4])				
No.	Voltage[v]①	Rotational speed[rpm]②	(Duration of video)	Weight[g]③
1	0.00	0	0:00	0
2	3.65	4178.0	0:32	0.8
3	3.93	4515.2	0:36	0.0
4	4.70	4804.1	0.42	-3.2
5	5.10	4963.9	0:52	-12.2
6	0.00	0	1:22	0

No. 1 Experiment begins.

No. 2 indicates that it has become slightly heavier (0.8 g). For example, if you place a scale under the rocket, it will show that it is heavier immediately after liftoff, so the value on the scale should be interpreted as being there to know about some change in thrust. (It is not the case that it will not lift off unless it is -1117 g of the main body weight.)

The scale for

No. 3 which is fitted with spikes, has started to slide sideways. Has upward thrust started to be generated?

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No. 4 is generating upward thrust.
No. 5 recorded the highest weight this time, -12.2 [g]. If we increase the rotation speed further to increase the upward thrust, it will likely float away from the weighing scale, rotate, and become unmeasurable, so we are not increasing the rotation speed any further. (Whether it will actually float is uncertain, but this is a prediction based on past experience.)
No. 6 the voltage was reduced to 0, the rotation speed also returned to 0 and the weight also returned to 0.

In the previous experiment using the outer ring of the conical roller bearing as the disk, the inner disk levitated at around 9000 rpm. This time, thrust was generated at around 5000 rpm, suggesting that the thrust increased due to the larger and heavier disk.

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■Conclusion for the next step

Because this structure is simple, it might be possible to obtain upward thrust proportional to the rotation speed. Next time, I'll try using two rotors so that the main body doesn't rotate.

That's all.

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