Introduction to JÖST

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Introduction: On a wing and a prayer
The Invite

At a family function my father's cousin and his son were discussing a German company that had invited them to visit for their 100 year celebrations. JÖST GmbH + Co. KG was formed in 1919 and this was their 100th year in the business of making Vibrating Equipment. As I listened I wondered how shaking something would help it move forwards. Simple physics did not explain this so I wanted to learn more.

A few questions later, and an email from my uncle to the Chairman of JÖST GmbH + CO. KG saw me getting invited to intern at JÖST in Germany for a week but with one catch: my internship would have to be completed either before the 100th year celebrations started or after these celebrations ended. Since the later would have meant that I would have missed school my parents and I decided to get me to Germany at least a week before the 100th year celebrations which were scheduled to begin on July 1st and end on July 5th. It was already June 13th and I had to be in Germany by the 23rd. I had just 10 days. I did not even know where in Germany this company was!

JÖST GmbH + Co. KG is located in the village of Buldern in Germany. Since the machines they make are huge and need a lot of space they have located their factories far away from any city. The nearest town was the historical town of Munster. It was recommended that I stay in Munster as there is nothing to do in Buldern. Munster is about 125km north-east of Dusseldorf and 275km north-west of Frankfurt.

The first thing I had to do was to write to Dr. Hans Moorman the Chairman of JÖST GmbH + Co. KG , with a recommendation from my uncle for an invitation to intern. After the invitation was received it was a mad rush to book air tickets, and hotel rooms and apply for a German Schengen Visa. Then in the midst of all this planning, Dr Moorman also offered me the option of being one of the representatives for JÖST at their stall in the GIFA/METEC exhibition in Dusseldorf for 2 days from June 27th to 28th. Now I had to get suits made so that I could be dressed for the occasion and I had 8 working days to do it all.

The Plan:

- Apply for and get my Visa by Friday the 21st of June
- Fly out from Mumbai on the night of Saturday the 22nd of June
- Arrive in Munster, Germany on the 23rd
- Start my internship on the 24th of June and continue to be with JÖST till the 26th.
- Then take a train to Dusseldorf and attend the JÖST stall from the 27th to the 28th
- Take another train on the evening of 28th June to Frankfurt and fly back from Frankfurt on the 29th morning.

The Surprise

In less than a day we had received an invitation from Dr. Moorman, booked hotels and flights, and the next day we applied for my visa. I don't know if Dr. Moorman wrote to anyone in the Indian passport office, but surprisingly within just 3 days of applying for my visa my mother received my passport with a visa for 1 month. Now I was really getting both nervous and excited.

I would be flying to Frankfurt then taking a train to Munster via Dusseldorf. In Munster my hotel would be next to the train station so all I had to was cross the road. From the hotel, one of Dr. Moorman's assistants, Ms. Hella would pick me up at 8am to take me to work every day.

The flight was uneventful. The train connection in Frankfurt was easy to get since there were instructions everywhere. In Dusseldorf, the train to Munster came on the same platform as the train from Frankfurt to Dusseldorf so that meant I did not have to carry my bags very far or change my platform.

I reached Munster on Sunday around lunch time. Found the hotel, checked in, and while unpacking, I went to sleep. I woke up to find that almost all of Munster was closed so had a quiet dinner in the hotel and prepared for Monday.

Linear and circular vibrataion: Testing how vibration is measured

Hella picked me up exactly at 8am. These Germans are very punctual. We reached Buldern in about 20 minutes. Hella took me up to the main office where I was greeted by **Dr. Hans Moorman**. He was very warm and welcoming and told me he would see me later for lunch at 12:15.

After Dr. Moorman left, Hella introduced me to **Konrad Terlau** and

Frank Domhoever. Konrad is in charge of testing all the vibrating machines in JÖST before they are sent to the customer. Konrad explained that at JÖST they test all machines several times during the manufacturing process and do a final test before despatch as it was easier to fix any problems before the machine was installed in the customer's factory.

Konrad and I then set down to taking measurements for one of the vibrating feeders that was available for testing. There is a

rather long list of measurements JÖST takes for each machine. The vibrating machine on the left is a small one so had only 22 measurements. Bigger machines like the one on the right had as many as 36 measurements.
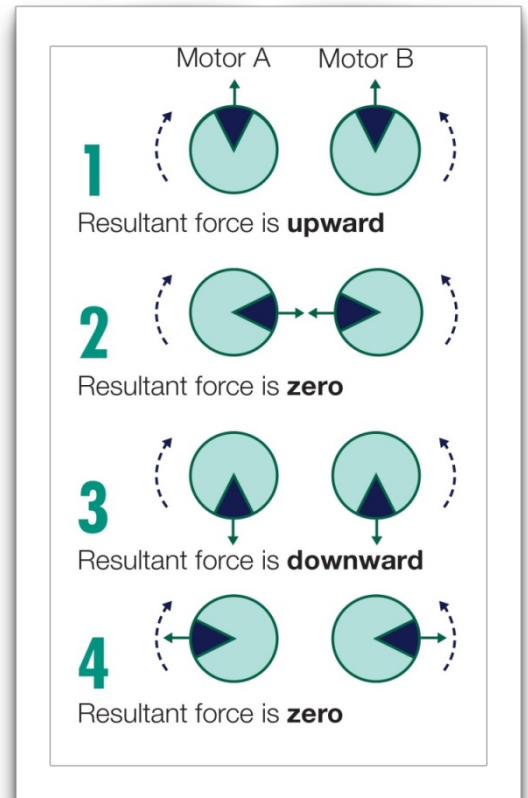
Using Vibration for linear motion

The active part of a Vibrating feeder is the Vibrating motor. To generate the vibrations flyweights are placed on either end of the motor shaft. The unbalance weights on the drive shaft produce an oscillating force as the motor rotates. Since the shaft of the motor rotates in a circular motion and a single Vibrating motor has a circular vibration as the unbalanced weights rotate.

However if you use 2 vibrating motors you can set them so that the forces of the motors cancel or add as shown in the diagram on the left.

When 2 unbalanced motors are installed on a feeder tray the motors can be aligned so that the forces in the vertical direction will cancel and the forces in the horizontal direction will add. The dynamic model shows the force vectors.

Motor A   Motor B

1 Resultant force is **upward**

2 Resultant force is **zero**

3 Resultant force is **downward**

4 Resultant force is **zero**

$$A_\circ = \frac{F/W}{\omega^2} = \frac{F/W}{(2\pi f)^2}$$

$$A_\circ = \frac{1}{(2\pi f)^2} \times \frac{F}{W}$$

By using 1 or 2 motors and aligning the motors so that their forces cancel or add one can create linear or circular motion. The amplitude $A_\circ$ is directly related to the F (centrifugal force in Newtons), and inversely related to the W (vibrating mass in kg) and f (rpm/frequency of the motor in Hz).

(a)   (b)
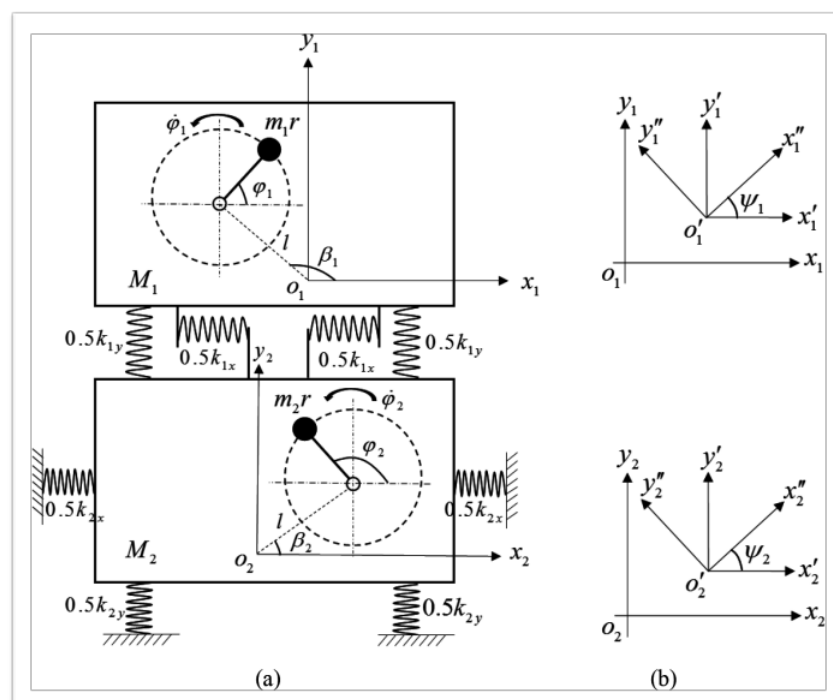
Below are pictures of machines that use vibrating motors to move material forward (on the left) or in a circular motion (on the right).