Gear Trains: Definition and Types [With PDF]

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When sometimes two or more gears are made to mess with each other to transmit power from one shaft to another such combination is called **gear trains**.

Contents

Types of Gear trains:

We have generally 4-types of gear trains, and those are:

- *Simple Gear Train*
- *Compound Gear Trains*
- *Reverted gear Trains*
- *Epicyclic Gear Trains*

So let’s dive into each one of the gear trains.

Simple Gear Trains:

When there is only one gear fitted on each shaft, then this type of gearing system named Simple gear trains.

Speed Ratio or You can say Velocity Ratio:

It is the ratio of the speed of the driver gears to the speed of the driven gears.

The ratio speed of any pair of gear is the inverse of the teeth.

Let consider,

- n1= Speed of gear 1 in RPM
- n2= Speed of gear 2 in RPM
- T1= Number of teeth in gear 1
- T2= Number of teeth in gear 2

So in the case of a simple gear train, the speed ratio is:

> n1/n2=T2/T1

Then another important factor you should know about and that is Train Value.

Train Value:

It is the ratio of the speed of driven gears to the speed of the driver gears is known as the train value.

So the train value of simple gear train is:

> n1/n2/=T1/T2

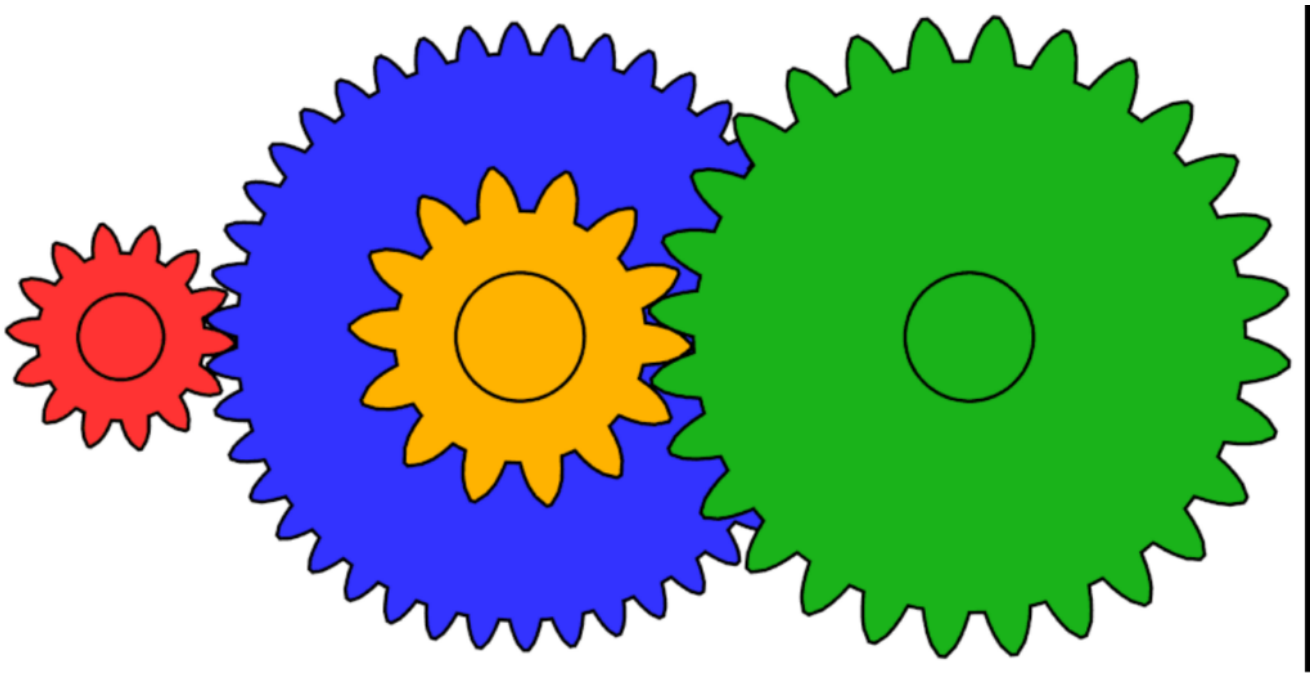
It may be noted that when the number od intermediate gear is odd the motion of both the driver gear and driven gear have the same direction of motion, but when the number of driver gear and driven gear even then we see the opposite direction of motion between driver and driven gears.

Compound Gear Trains:

When we need higher speed ration or a much lower speed ratio then we need to use compound gear trains.

In this case, each intermediate shaft has two-gears rigidly fixed to it.

Due to both the gears fitted on the same shaft, we can see the same speed in both the gears.



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Speed ratio for Compound Gear Trains:

If there are six number of total gears and:

- n1= Speed of gear 1 in RPM
- n2= Speed of gear 2 in RPM
- n3= Speed of gear 3 in RPM
- n4= Speed of gear 4 in RPM
- n5= Speed of gear 5 in RPM
- n6=Speed of gear 6 in RPM
- T1= No. of teeth of gear 1
- T2= No. of teeth of gear 2
- T3= No. of teeth of gear 3
- T4= No. of teeth of gear 4
- T5= No. of teeth of gear 5
- T6= No. of teeth of gear 6

Then the speed ratio would be:

> n1/n2*n3/n4*n5/n6=T2/T1*T4/T3*T6/T5

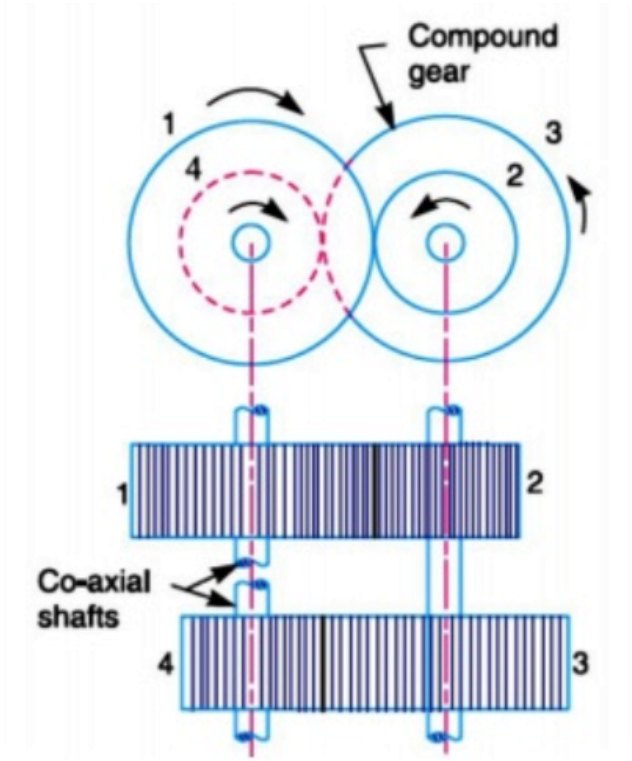
> n1/n6= T2/T1*T4/T3*T6/T5

[As n2 and n3, n4 and n5 is on the same shaft so the rpm of both the gears are same, therefore, n2=n3, n4=n5]

Reverted gear Trains:

In the case of the reverted gear train, the driver and the last gear are Co-axial.

This type of arrangement is used in clocks and in simple lathe where back gears are used to give a slow speed to the chuck.



So the speed ratio for reverted gear trains is:

> n4/n1= Product of number of teeth on driving gears/product of the number of teeth on driven gears

Epicyclic Gear Trains:

The epicyclic gear train is useful for transmitting high-velocity ratio with a gear of moderate size and in less space.

We use an epicyclic gear train in Wrist Watch.

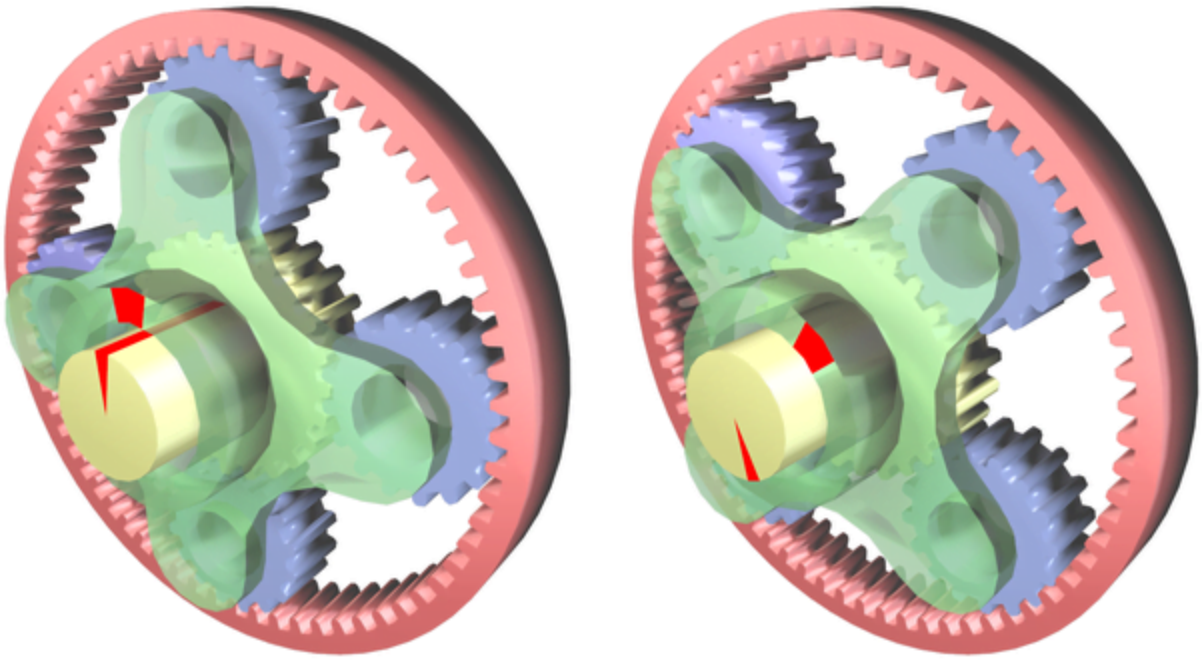


Table of Motions for Epicyclic gear trains:

Suppose an Epicyclic Gear Train has 2 gears (Gear A and Gear B) and an Arm (Arm C).

Then the table of motion looks like this:

CONDITION OF MOTION	ARM C	GEAR A	GEAR B
The arm is fixed gear a rotates through the +1 revolution anticlockwise.	0	+1	-Ta/Tb
Arm fixed gear a rotates through +x revolution	0	+x	-x *Ta/Tb
Add +y to all elements	+y	+y	+y
Total Motion	**+y**	**+x+y**	**y-x*Ta/Tb**

This table is the same for all the problems regarding epicyclic gear trains, you just need to calculate the value by solving these bolded equations.

So this is all about gear trains, I hope you like this short presentation. However, feel free to share your opinions on the comment section, I would love to see those.

Some FAQ:

What are the types of gear trains?

We have generally 4-types of gear trains, and those are:

1. *Simple Gear Train*
2. *Compound Gear Trains*
3. *Reverted gear Trains*
4. *Epicyclic Gear Trains*

What is a compound gear train?

In compound gears, each intermediate shaft has two-gears rigidly fixed to it.

What is epicyclic gear trains?

The epicyclic gear train is useful for transmitting high-velocity ratio with a gear of moderate size and in less space.

What is an inverted gear train?

In inverted gear trains, the driver and the last gear are Co-axial.

References:

- https://science.howstuffworks.com/transport/engines-equipment/gear-ratio3.htm
- https://www.sciencedirect.com/topics/engineering/gear-train