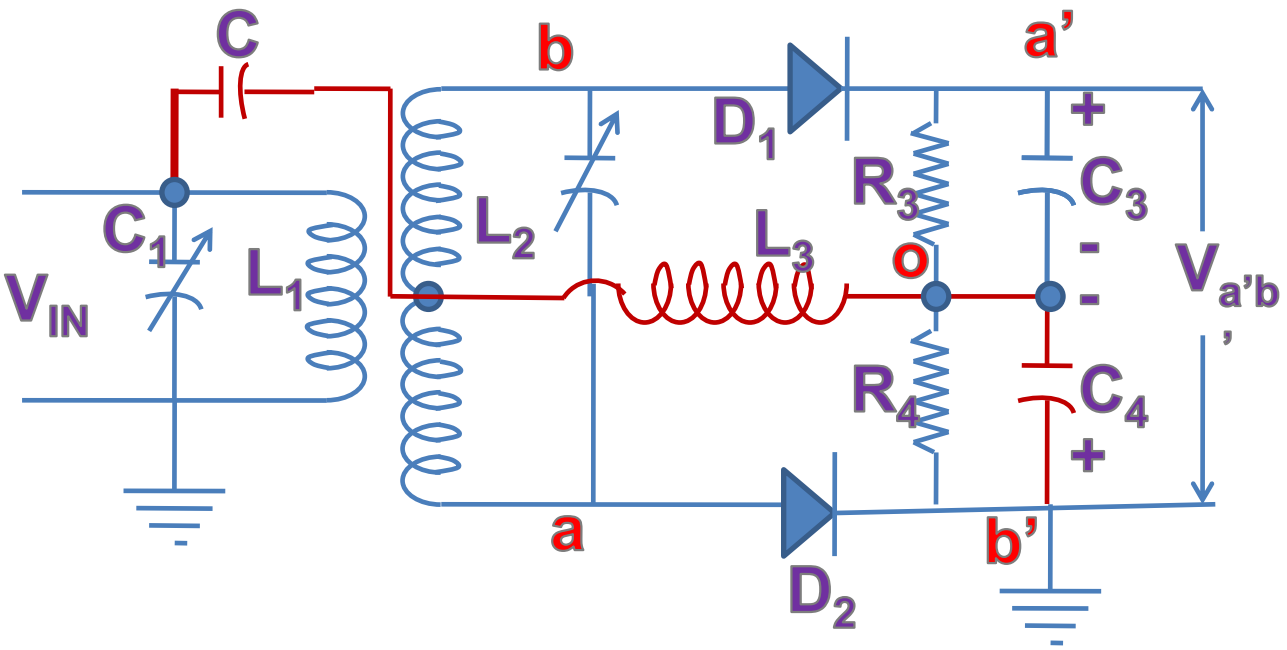
Balanced Slope Detector-Drawbacks

- Even more difficult to tune, as there are three different frequencies to be tuned.
- Amplitude limiting still not provided.
- Linearity, although better than single slope detector, is still not good enough.

Foster-seley Phase Discriminator

- In this all the tuned circuits are tuned to the same frequency.
- Balanced Slope Detector circuit with some changes is used.
- This circuit yields far better linearity than slope detection.

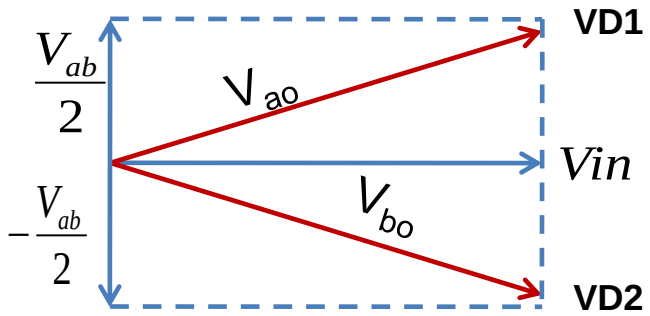
Foster-seley Phase Discriminator



Foster-seley Phase Discriminator

- When input frequency = f_c

  The phase shift between primary and secondary winding is 90’ and the output of D1 is equal to the output of D2

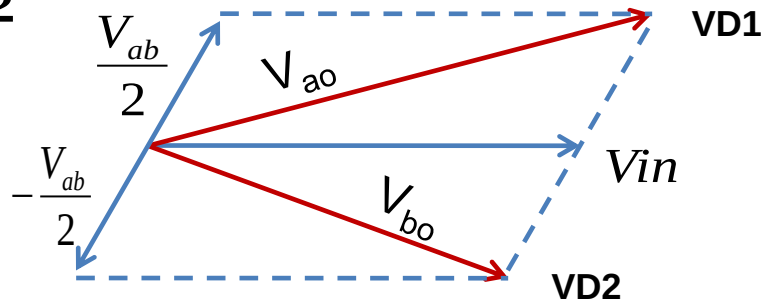


- **That as V_{ao}=V_{bo}, hence discriminator output is zero.**

Foster-seley Phase Discriminator

- When input frequency = fc+δf

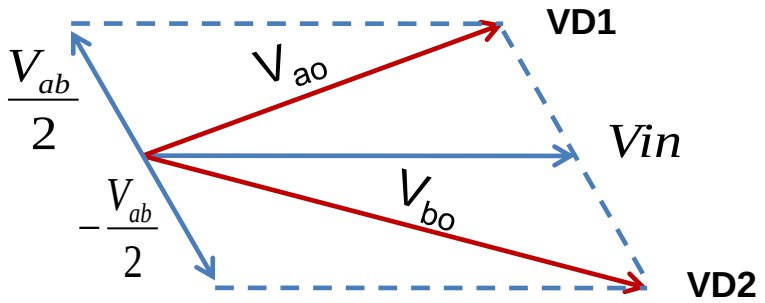
–The phase shift between primary and secondary winding is not equal (less) to 90’ and the output of D1 is more than the output of D2



- That as $V_{ao} > V_{bo}$, hence discriminator output is positive.

Foster-seley Phase Discriminator

- When input frequency = fc-δf
  - The phase shift between primary and secondary winding is not equal to 90’ and the output of D1 is less than the output of D2



- That as $V_{ao}<V_{bo}$, hence discriminator output is negative.

Foster-seley Phase Discriminator

- It is much easier to align, as there are now two tuned circuits and both are tuned to the same frequency.
- Linearity is quite better, as circuit relies less on frequency & more on primary-secondary phase relation, which is quite linear.
- Only drawback is, there is no provision for amplitude limiting.

Ratio- Detector

- Ratio detector demodulator is modified Foster-Seeley circuit in order to incorporate amplitude limiting.

- In Foster-Seeley discriminator that sum of voltages $V_{ao}+V_{bo}$ Should remain constant,

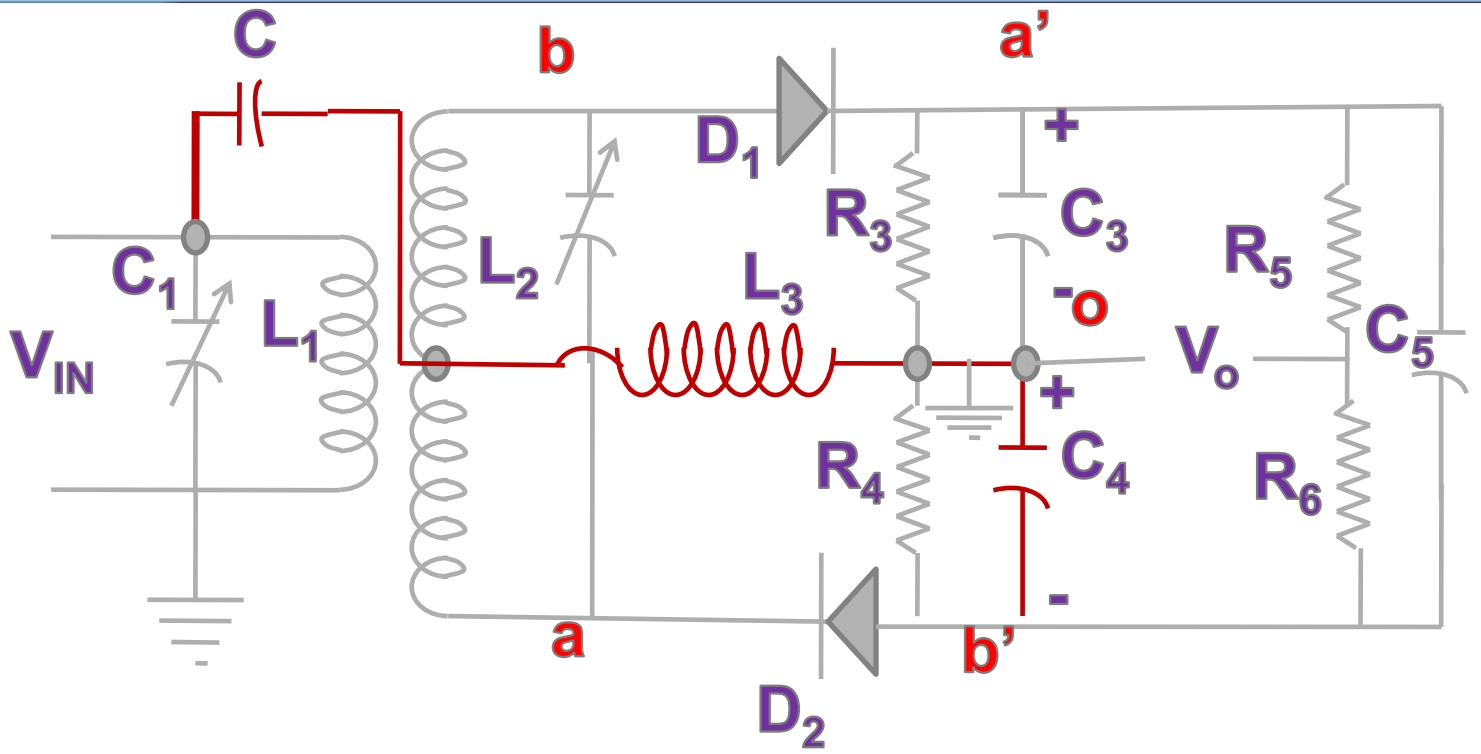
- and their difference should vary due to variation in input frequency.

Ratio- Detector

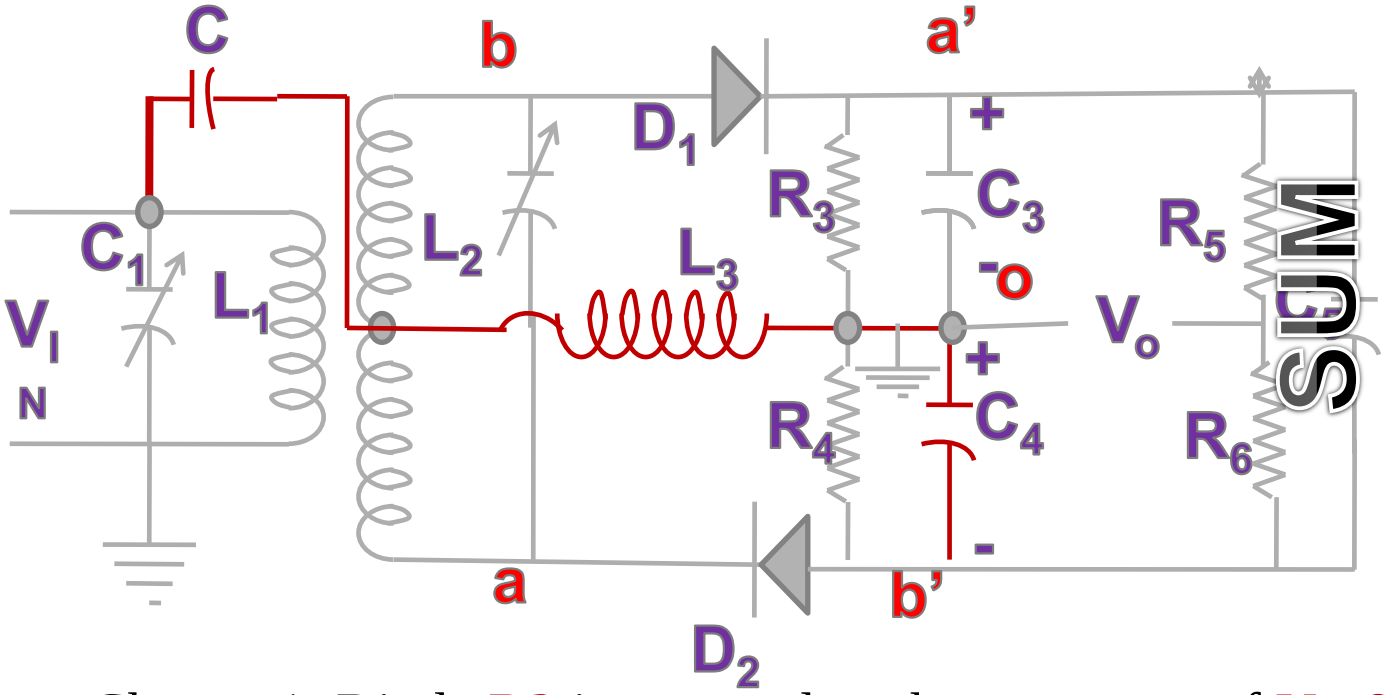
- But practically speaking any variation in the amplitude of input signal, also has impact on sum of $V_{ao}+V_{bo}$, leading to distortion.

- Ratio-detector circuit eliminates this variation of $V_{ao}+V_{bo}$, and performs the function of amplitude limiter also.

Ratio- Detector

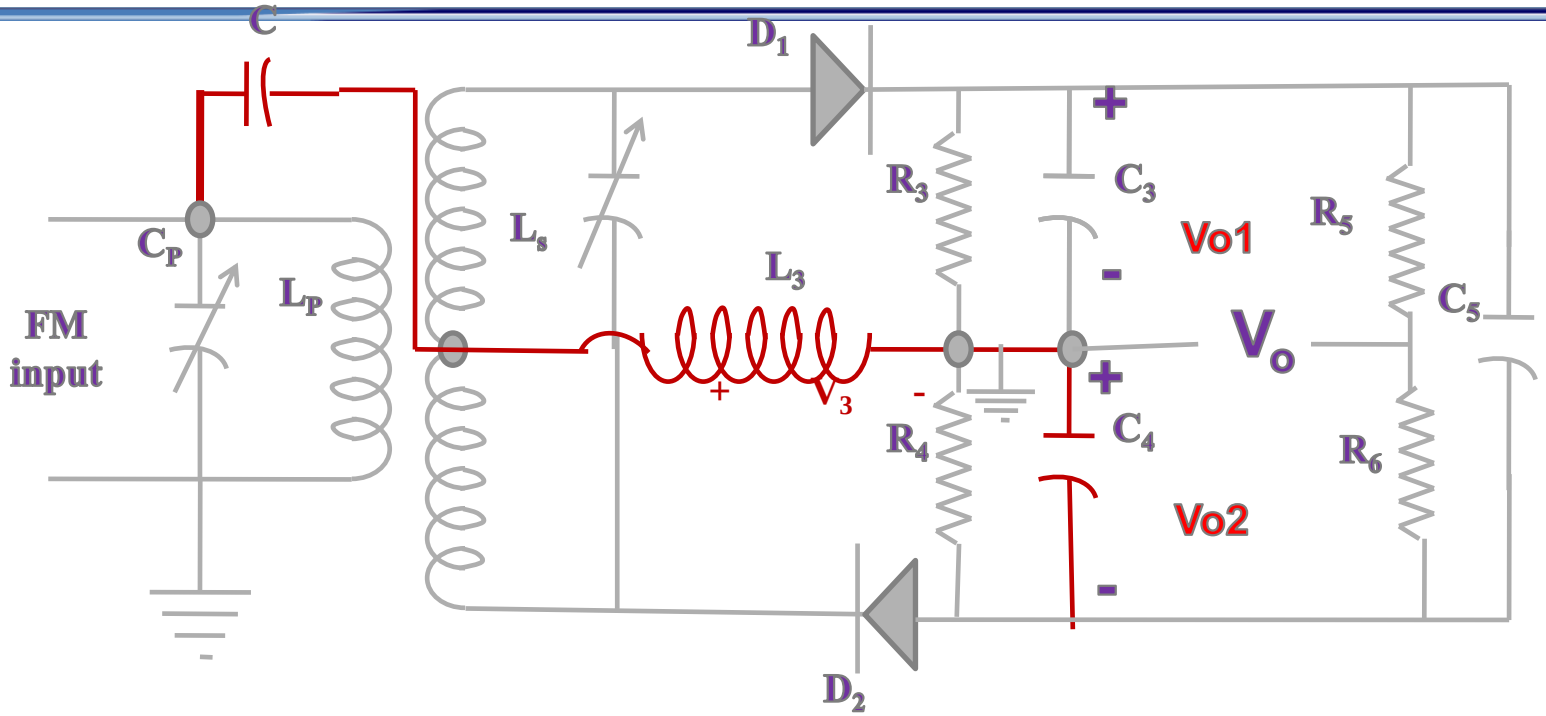


Ratio- Detector



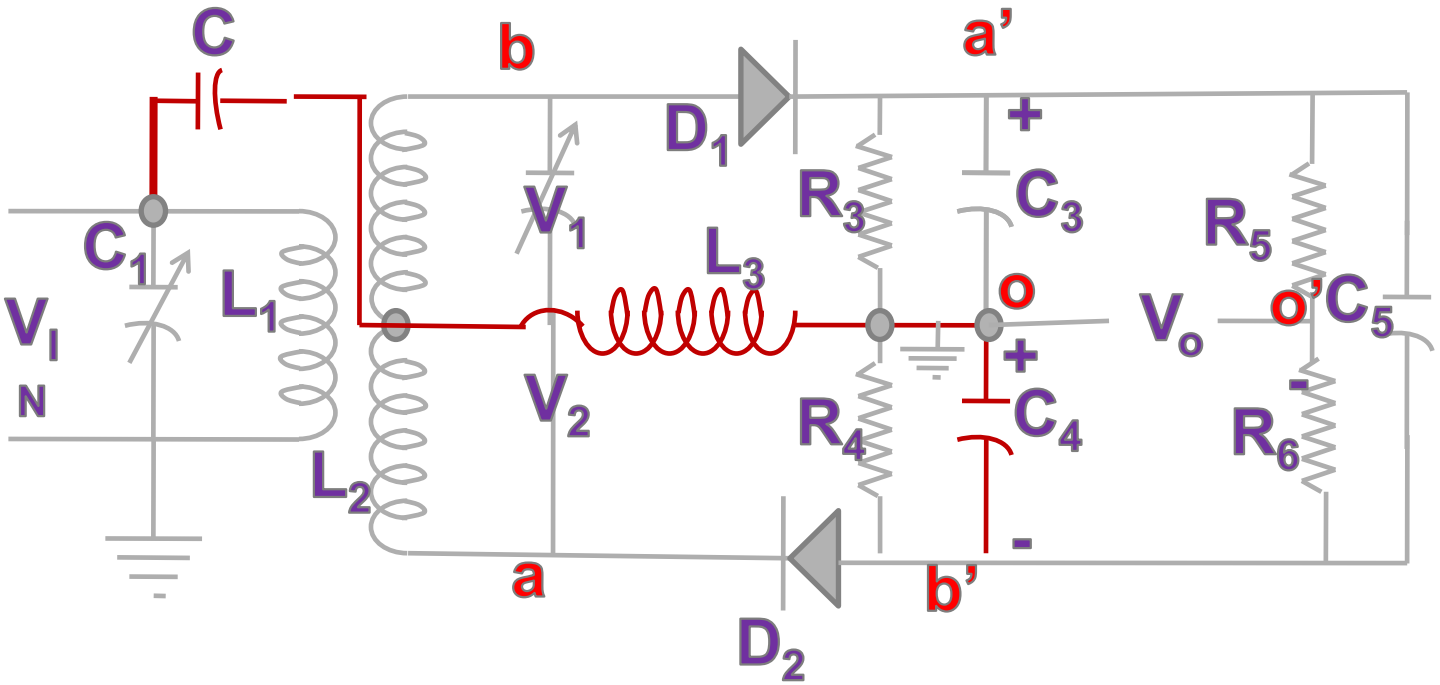
Change 1: Diode D2 is reversed so that now sum of V_{ao} & V_{bo} appears across points a' and b' instead of difference.

Ratio- Detector



Change 2: A capacitor C_5 with large time constant is connected across a'-b' in order to keep $V_{ao}+V_{bo}$ constant.

Ratio- Detector



Change 3: Output is taken from o-o' as the difference of V_{ao} & V_{bo} appears there. Ground is shifted to O'.

Performance Comparison of FM Demodulators

S.No.	Parameter of Comparison	Balanced Slope detector	Foster-Seeley (Phase) discriminator	Ratio Detector
(i)	Alignment/tuning	Critical as three circuits are to be tuned at different frequencies	Not Critical	Not Critical
(ii)	Output characteristics depends on	Primary and secondary frequency relationship	Primary and secondary phase relation.	Primary and secondary phase relation.
(iii)	Linearity of output characteristics	Poor	Very good	Good
(iv)	Amplitude limiting	Not providing inherently	Not Provided inherently	Provided by the ratio detector.
(v)	Amplifications	Not used in practice	FM radio, satellite station receiver etc.	TV receiver sound section , narrow band FM receivers.