TUNING METHODS

Evaluated by Paul Guy

There are several popular methods commonly used to tune guitars. Some of them work well, others don't work at all. The following is an evaluation of the most common methods, and of the method that works best for me.

Unison method (4th/5th fret method) - Correct

The old faithful "4/5" method is perfectly correct in principle, since unison intervals are used. For those readers from Mars who aren't familiar with it, the method is as follows: one string (usually high E) is tuned to a reference frequency ("Oi! Fred! Gimme an E!").

The 5th fret E on the B string is tuned to match the open E,
the 4th fret B on the G string is tuned to match the open B,
the 5th fret G on the D string is tuned to match the open G,
the 5th fret D on the A string is tuned to match the open D,
finally the 5th fret A on the low E string is tuned to match the open A.

If you have tuned accurately the interval between the two E strings will be exactly two octaves - the 5th fret double octave harmonic on the low E should sound at the same pitch as the open high E. The problem with this method is that if you get one string wrong, the following strings will also be out. But if you have a well-adjusted guitar and a good ear, it can work well.

Octave method - Correct

Any tuning method using octaves is correct in principle. There are many variations - one way is to tune the open B string one octave below the 7th fret B on the high E string, the open G string one octave below the 8th fret G on the B string, the open D string one octave below the 7th fret D on the G string, the open A string one octave below the 7th fret A on the D string, and - you guessed it - the open low E one octave below the 7th fret E on the A string.
But we're back to small errors affecting the following strings again. To avoid this, and because tuning errors become more obvious further up the fingerboard, make your comparisons using only fretted octaves between the 7th and 12th frets, and try tuning in this order:

Tune low E two octaves below high E.
Compare high E and D - tune D.
Compare high E and G - tune G.
Compare D and B - tune B.
Compare G and A - tune A.

Recommended methods

If you tune all the strings to the same reference string, you can avoid a small error on one string affecting all the others.

Tune the high E string to a reference: compare
5th fret E on the B string: adjust B
9th fret E on the G string: adjust G
14th fret E on the D string: adjust D
7th fret E on the A string (one octave below); adjust A
5th fret harmonic on the low E string: adjust low E.

I have found this to be the easiest and most reliable way of tuning I have ever used. Since you are listening to the same note all the time, the ear "tunes in" to the overtones and an out-of-tune string sticks out from the rest like a sore thumb. It is also useful for tuning with electronic tuners of doubtful accuracy, as even the cheapest nastiest tuner will (usually) give the same readout for the same input frequency.

Another method which works very well - and which I still use as a cross check on the above (if I feel the need) is as follows:

Tune high E to a reference:
Tune 5th fret harmonic on low E to match open high E:
12th fret harmonic on low E / fretted 7th fret E on A string: adjust A
12th fret harmonic on A / fretted 7th fret A on D string; adjust D
12th fret harmonic on D / fretted 7th fret D on the G string; adjust G
12th fret harmonic on G / fretted 8th fret G on B string; adjust B
Check that 12th fret harmonic on B matches fretted 7th fret B on high E.

This method worked well for me - and for many of my customers - for many years. (It is also extremely effective at getting the best available results out of a poorly adjusted instrument.)

Bad ideas

5/7 Harmonics method - Does not work!
This method seems to have a strange attraction for many guitarists. Not least because it's such a convenient method, which leaves the fretting hand free to tune with, many guitarists cling stubbornly to harmonics tuning, despite the recurrent tuning difficulties it causes.

The simple fact is that the method cannot possibly work, as all harmonics are pure intervals, and the frets are placed to give equal tempered intervals. With the exception of the octave and double octave harmonics (octaves are pure in both the pure and the tempered scales) harmonics should not be used for fine-tuning.

The most common harmonics method is the "5/7" where the high E is tuned to a reference, and the 5th fret harmonic on the low E, to the open high E.
The 7th fret harmonic on the A is tuned to the 5th fret harmonic on the low E.
The 7th fret harmonic on the D is tuned to the 5th fret harmonic on the A.
The 7th fret harmonic on the G is tuned to the 5th fret harmonic on the D.
The 5th fret harmonic on the B is tuned to the 7th fret harmonic on the high E.

Many users of this method also delude themselves that the 4th fret harmonic on the G string should sound the same frequency as the 5th fret harmonic on the B string.

A guitar tuned this way will, quite simply, not play in tune. The reason is simple - the 7th fret harmonic on the A string sounds the note E, the fifth . But this is a pure fifth interval (to be pedantic, an octave and a fifth). The tempered fifth is lowered two cents from pure. The resulting open A note will therefore be two cents flatter than the tempered A we want. The interval between the low E and the A strings should be a tempered fourth, which is raised two cents from pure. Since the A string has been tuned two cents flat the E - A interval will be flat by the same amount.

Two cents isn't much but when you tune the D to the A the same way, the D ends up four cents flat. When you get to the G you will be six cents flat. Tuning the 5th fret harmonic on the B string to the (pure fifth) 7th fret harmonic on the high E leaves the open B sharp by two cents. The resulting open G to open B major third interval will be eight cents sharp.

Trying to tune the B string to the G by harmonics will really get you into trouble. The 4th fret harmonic on the G string sounds the major third of G - a B note. But again, this is a pure interval. The tempered third is raised fully 14 cents from pure. Tuning the 5th fret harmonic on the B string to the pure third on the G will leave the B 14 cents flat. Try it and then compare the 4th fret B on the G string to the open B - you'll see what I mean. It should be obvious by now that harmonics - other than octaves - are not to be trusted! They are useful for the initial coarse tuning, however, as the fretting hand is free to tune while both strings are sounding. Just don't try to use them to fine tune.

Tuning pairs of open string by counting beats - Good luck!
All "by ear" tuning ultimately depends on the use of beats - the tremolo (regular variation in volume) produced by interference effects when two notes are played together - in unison or other intervals - and the interval is not precisely pure. The closer to pure, the slower this tremolo, until it disappears altogether when the interval is pure. The speed of this tremolo is also relative to the interval's absolute pitch - the higher the pitch, the faster the tremolo.

Inexperienced guitarists often try to tune the guitar by tuning for zero beats between pairs of adjacent open strings. For example, they play the open E and A strings together, and tune the interval so that the beats disappear. Next they play the open A and open D together, and so on. The problem with this method is exactly the same as with the harmonics method - i. e. that the intervals are being tuned pure, and the guitar must be tuned to tempered intervals. If the open E and A strings are tuned beat-free, the interval will be two cents too narrow. If the open G and B strings are tuned the same way, the interval will be fourteen cents too narrow. A guitar in exact equal tempered tuning sounds the following beats between pairs of strings:

String 6 5 4 3 2 1
Note E A D G B E
Interval Fourth Fourth Fourth Third Fourth
Beats 0.3/sec 0.5/sec 0.6/sec 8/sec 1/sec

It's easy enough to hear when the beats disappear, and to tune the intervals pure. It's much harder to learn to count the beats accurately enough to tune the guitar correctly by them. Most of us will find it much easier to use another method.

Tuning to a chord - No way!
Tuning one chord so that it sounds perfect just causes all other chords to sound terrible. In tempered tuning all chords are slightly "out", but all by the same small amount. Remember that the tempered scale is a compromise that enables us to play all chords and intervals, in all keys, with the same relative accuracy. It therefore follows that there is not one chord on the guitar that tunes absolutely pure. Thus it is a total waste of time to tune the guitar to a chord and expect it to sound pleasing anywhere else. If you can't swallow these facts, then for your own peace of mind, you're probably better off if you give up the guitar and get a flute or a sax or something instead. With experience, though, you can develop an ear for even tempered tuning.

Tuning tips
1. Learn to attach the strings to the machine heads properly!

2. Never try to tune down to a note - first tune below the target pitch, then stretch the string, then tune up to the note. (To avoid problems caused by the "play" in 99% of tuning machines.) Make a couple of deep bends (you don't have to actually play the note, just bend it to settle the tension) then fine tune.

3. Before tuning a string that you suspect is out, check it against both adjacent strings! Many guitarists make the mistake of tuning the wrong string! Oftentimes you think your G is sharp when in fact it's the D that's flat, for example. I do sometimes, and when I watch other people tuning, it seems to me that they do too...

4. When tuning a guitar with a vibrato arm, tune the string, give the arm a good shake, stretch the string, give the arm another shake, and fine tune. On the plain strings I also like to bend the string a whole tone a couple of times (somewhere around the middle) before fine-tuning.

5. Listen for the beats!
Those who find it difficult to hear whether an interval is in tune or not have usually just not learned the trick yet. It's like riding a bike, or swimming - once you've got it, it's dead simple. Learning to listen for the beats is the answer. Play the two notes together - say the open low E string and the E on the D string at the second fret - and let them ring.

If they are not precisely in tune you will hear a tremolo (regular variation in volume) produced by interference effects. This is called "beating". Tuning either one of the strings will either a) cause the beats to increase in speed, which means that you are going the wrong way, or b) cause them to slow down and eventually stop altogether when the two notes are perfectly in tune.

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