Clinometer

Science, Physics

Clinometer (forestry) From Wikipedia, the free encyclopedia Jump to: navigation, search A clinometer used in forestry The clinometer, known in many fields as an inclinometer, is a common tool used in forestry to measure slope, vertical angles, and – in combination with distance measurements – elevation change or tree heights. How it works A forester using a clinometer makes use of basic trigonometry. First the observer measures a straight-line distance D from someobservationpoint O to the object. Then, using the clinometer, the observer measures the angle a between O and the top of the object.

Then the observer does the same for the angle b between O and the bottom of the object. Multiplying D by the tangent of a gives the height of the object above the observer, and by the tangent of b the depth of the object below the observer. Adding the two of course gives the total height (H) of the object, in the same units as D. [1] Note that since multiplication is distributive it is equally valid to add the tangents of the angles and then multiply them by D: A = tan a B = tan b H = (A ? D) + (B ? D) = (A + B) ? D Note also that both angles should be positive numbers (i. . ignore any minus sign on the clinometer's scale). Units of measure There are typically three different units of measure that can be marked on a clinometer: degrees, percent, and topo. When buying a clinometer it is important to make sure it is calibrated to units suitable for the intended use.

Tree height measurement Tree height measurement The forester stands at a fixed distance from the base of the tree. The most common distances in the United States are 50 feet (15. 24 m), 66 feet (20. 12 m), and 100 feet (30. 48 m). 2] To obtain accurate readings it is best to use taped measured distance

instead of paced distances. For the most accurate readings it is best to use a distance that is not less than the height of the tree being measured. [3], that is, that the clinometer will measure an angle less than 45° (100%). The observer sights to the top of tree, if total height is the desired measurement. If the desired measurement is merchantable height – that is, the height producing timber that can be sold – the observer sights to a point on the tree above which no more merchantable timber is found.

The observer then measures to the bottom of the tree, takes the tangents and multiples them by the distance, and adds the two figures together. This will be the height of the tree. The observer must always measure a leaning tree so that the tree is leaning to the left or right. Measurements should never be taken with the tree leaning toward or away from the observer because this will affect their accuracy because of foreshortening. Slope measurement Measuring slope with a clinometer

The clinometer is also commonly used by foresters to obtain the percent slope of terrain. This measurement is based on the same trigonometric principles described above. Slope measurements, however, require that both observer and target be a constant height above the ground; thus a range pole or height of measurement (HI) stick is often used in slope measurements. The Clinometer The clinometer is an optical device for measuring elevation angles above horizontal. The most common instruments of this type currently used are compass-clinometers from Suunto or Silva.

Compass clinometers are fundamentally just magnetic compasses held with their plane vertical so that a plummet or its equivalent can point to the elevation of the sight line. A better clinometer (I believe) is the Abney hand

spirit level or clinometer, where the object sighted and the level bubble can be seen simultaneously, so that the index can be set accurately. An Abney clinometer is shown in the photograph. A spirit level is so-called because it contains alcohol in a tube of large radius, in which the bubble moves to the highest point.

Spirit levels are used for accurate surveying, although automatic levels that go back to the principle of the plummet are now frequently found, and are easy to use. The Abney clinometer has a sighting tube with an angle scale reading from -90° to +90°, and a spirit level with a Vernier index that can be moved along the scale while the user looks through the sighting tube. A small mirror and lens makes the level bubble visible in the field of view. When the object is aligned with the crosshair in the sighting tube, the spirit level is rotated so that the bubble is bisected by the crosshair, as illustrated in the diagram.

Then, the elevation of the line of sight can be read off on the scale. The Vernier can be read to 10', but it requires a magnifier to do this. The clinometer can read easily and accurately angles of elevation that would be very difficult to measure in any other simple and inexpensive way. A fairly common use of a clinometer is to measure the height of trees, which is easily done. A point should be marked with a stake as far from the centre of the trunk of the tree as its estimated height, so that the elevation angle is about 45°, which gives the best " geometry. This distance D is measured with a tape. The observer then stands over the stake and sights the top of the tree, finding its elevation angle ?. The height H of the tree is then H = D tan ? + HI, where HI, the height of instrument, is the height of the observer's eye. All

this is illustrated in the diagram. A useful accessory is a levelling rod, which can be home-made at little expense. Since the clinometer has no powerful telescope, the reading of the rod must be evident from a distance if you use it as a self-reading rod.

Alternatively, if you have a rodperson, she can stand by the rod and move a finger or other marker up and down in response to your signals, then measure the distance with a tape. A self-reading rod can be made from a 1" x 4" x 10' choice pine board available at Home Depot. A bold pattern that can be estimated to a few centimetres can then be applied by stencil and matte black spray paint. Two examples are shown at the right. Colors can also be used to make distinctions. The determination of the difference in elevation of two points is called levelling, and can be carried out with the clinometer set at 0°.

The place where you stand with the level is called a turning point, TP. Your rodperson holds the rod on the first point, and you make a backsight, BS, by reading the rod. The reading is the HI above the first point. Now the rod is held on the second point, and a foresight, FS, is taken. Foresights and backsights should be roughly equal in distance. The difference in elevation of the two points is BS - FS. This procedure is illustrated at the left. If both points cannot conveniently be viewed from one TP, a chain of turning points is used, with an intermediate elevation between each one.

The difference in elevation is the sum of the backsights less the sum of the foresights. If the sights are short, such as those that are practical with the clinometer, the curvature of the earth will be taken into account automatically. Clinometer Clinometers are measuring devices that may be

used in several different professions. Also known as an inclinometer, the essential function of the device is to determine accurate measurements as they relate to sloping, height and distance.

The clinometer is often used in the profession of meteorology, as well as in forestry and surveying. One of the most common applications of the clinometer has to do with measuring angles as they relate to the slope of natural formations or buildings and other human construction projects. The idea is to measure the angle with an eye toward identifying any amount of slope, withrespectto the gravity that is involved. The clinometer may be used to measure both inclines and declines, based on the perspective of the individual calculating the measurements.