Constant Force Strength Trainer

Design a low cost mechanism that will provide a constant* force resistance
For a home gym exercise system

A new fitness products company “Pump-U-up” (PUP), wants to introduce a low
cost, compact, strength building machine “FLEX-force” (FF) into the “home use”
marketplace. PUP expects strong competition from the many current entries in
this market including the popular “Bowflex” system, (http://www.bowflex.com)

PUP has hired your consulting engineering team to design a constant force
resistance module (RM) that will be the heart of the FF unit. Marketing surveys
and focus groups have suggested a FF system unit price range of $300 - $1000
based on the consumer desire for a low cost, and compact machine that will
enable a high quality strength workout in a short period of time. Reliability, and
near zero “set-up” time (changing body positions and resistance level) is said to
be the key to sales. Another key to achieving a low cost position is thought to be
low system weight – ruling out the common use of “weight stacks” in many
exercise systems.

Initial concepts for the FF machine call for compact resistance modules to be
interfaced to the user by means of a cable system that can be positioned
anywhere in the space around the user to provide constant but selectable
resistance for a full range of body motions. The resistance force that the system
provides for the user should be for both “concentric” and “eccentric” modes of
human force application.

Create and justify a design for the RM that will result in an attractive business
opportunity for PUP. Design justification should demonstrate how the
performance (including failure mode impacts)/ cost metrics for the RM fit within overall
assumptions of venture “value” for PUP.