



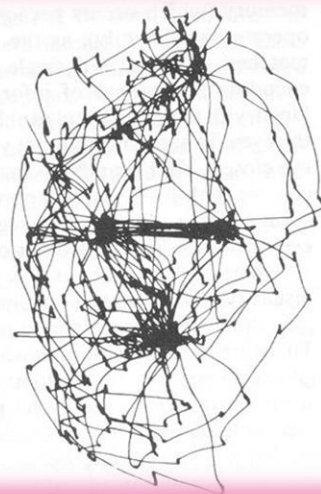
# کنترل سیستم های عصبی-عضلانی

کنترل حرکت چشم و مدل های آن

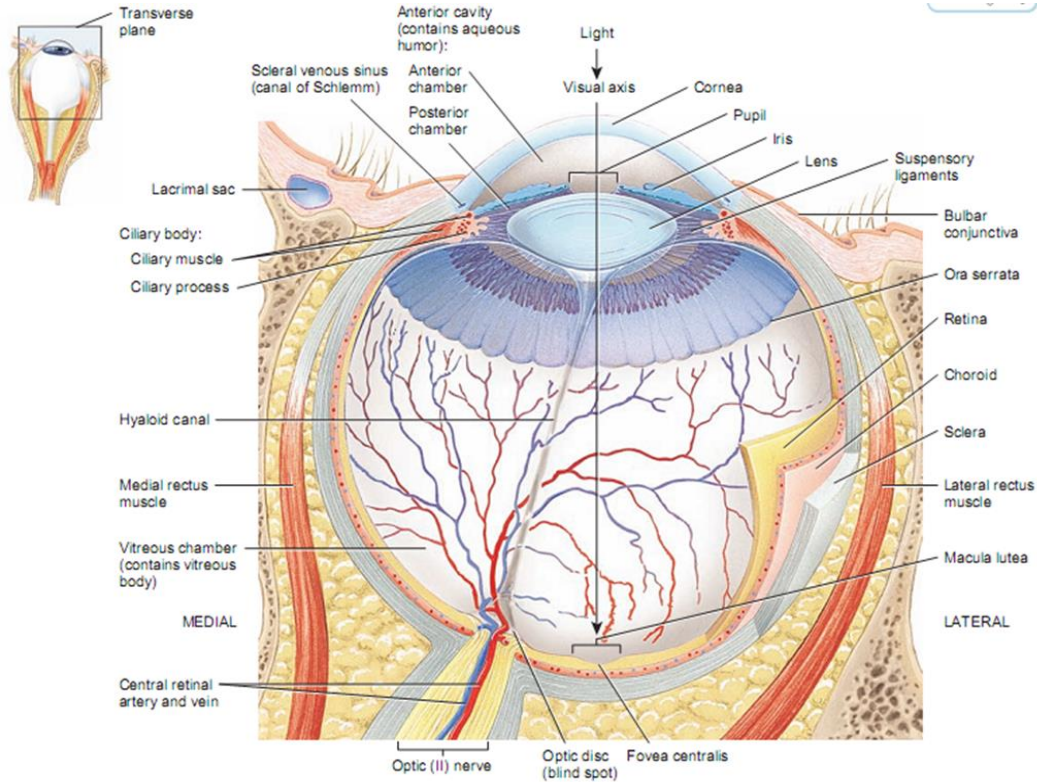
*Eye Movement and Its Models*

# فهرست مطالب:

- **آناتومی چشم** ←
- قشر بینایی و اعصاب چشم
- عضلات چشم
- حرکتهای چشم
- مدل های حرکت چشم



# آناتومی چشم



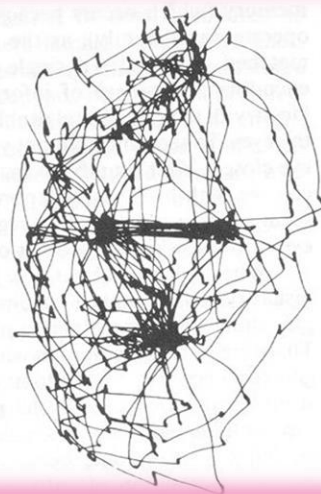
Superior view of transverse section of right eyeball

**Table 9.1**      **Functions of the Parts of the Eye**

Part	Function
Sclera	Protects and supports eyeball
Cornea	Refracts light rays
Pupil	Admits light
Choroid	Absorbs stray light
Ciliary body	Holds lens in place, accommodation
Iris	Regulates light entrance
Retina	Contains sensory receptors for sight
Rods	Make black-and-white vision possible
Cones	Make color vision possible
Fovea centralis	Makes acute vision possible
Other	
Lens	Refracts and focuses light rays
Humors	Transmit light rays and support eyeball
Optic nerve	Transmits impulse to brain

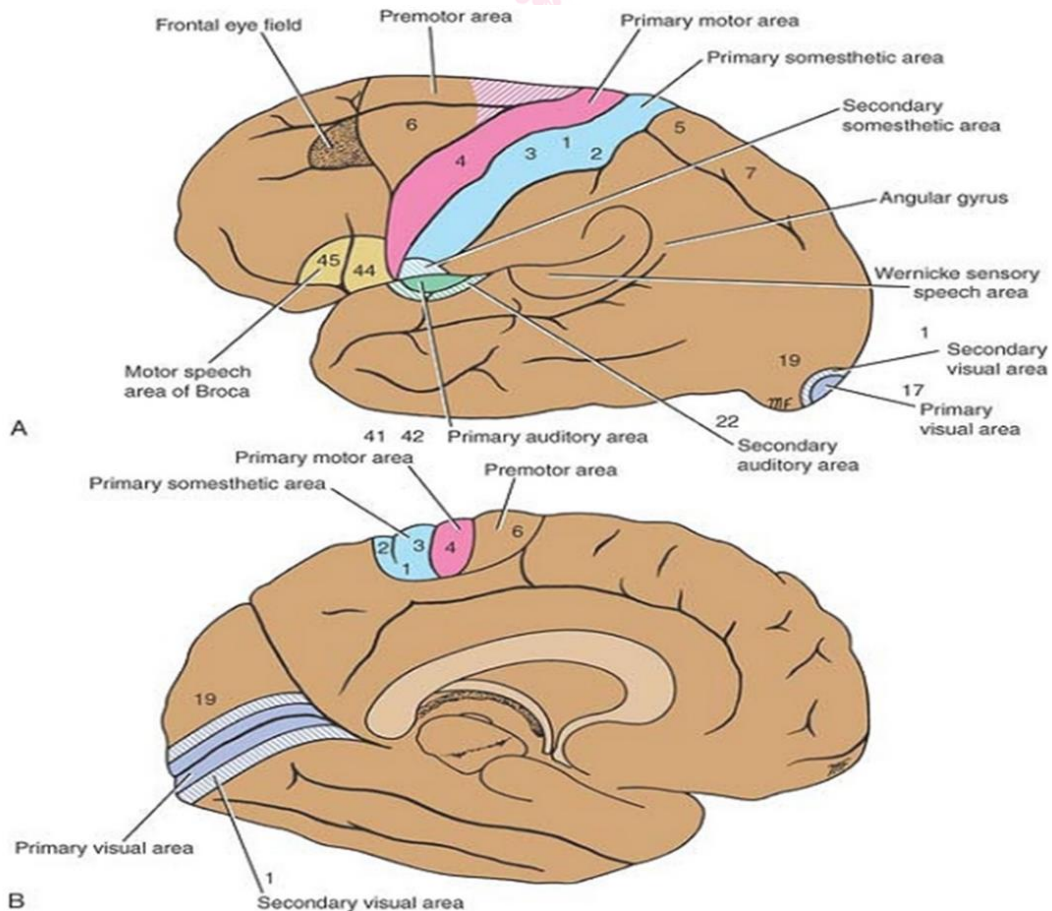
# فهرست مطالب:

- ✓ آناتومی چشم
- ← قشر بینایی و اعصاب چشم
- عضلات چشم
- حرکتهای چشم
- مدل های حرکت چشم

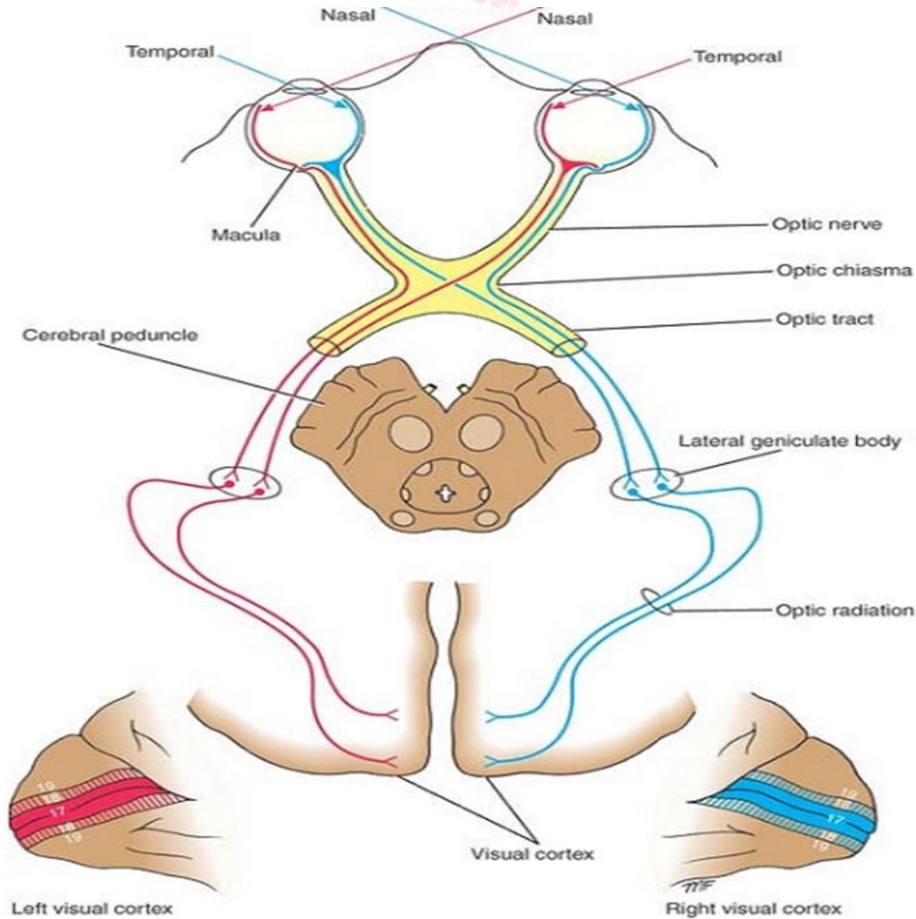




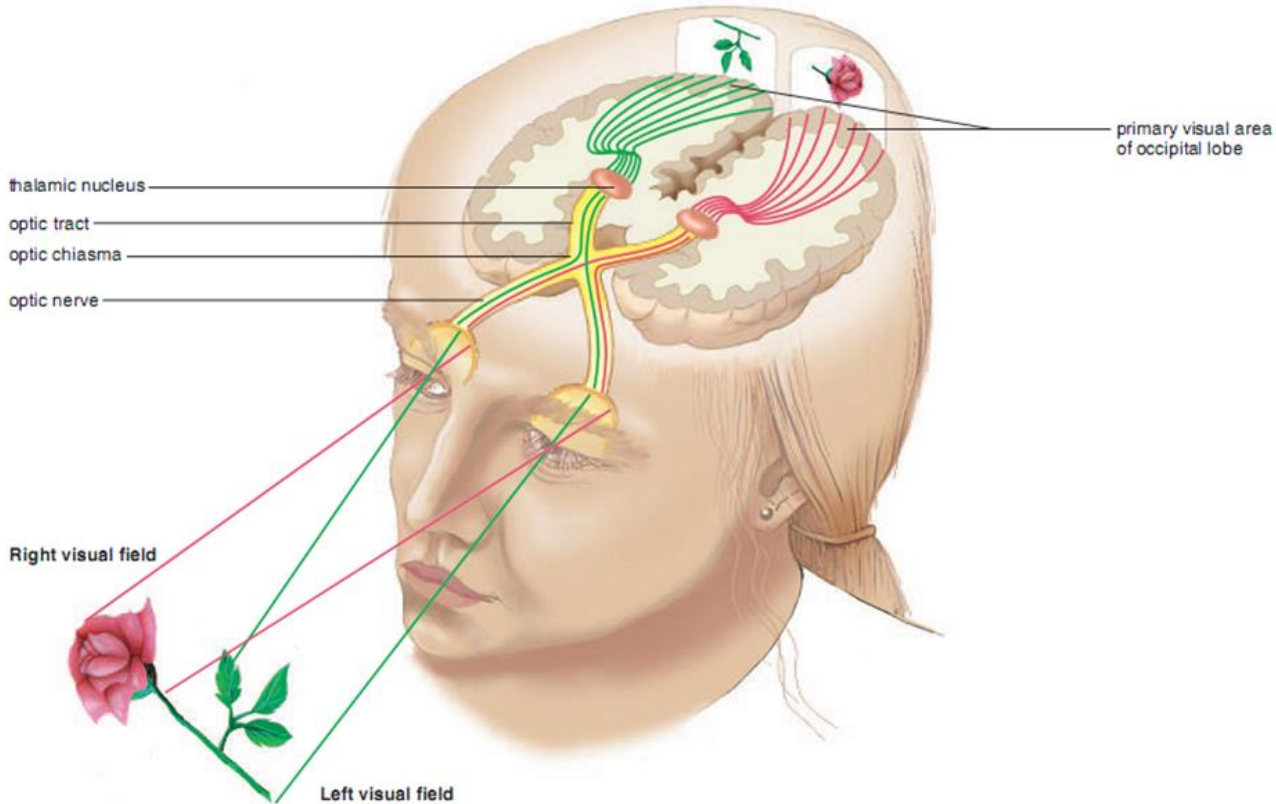
# قشر بینایی در مغز



# مسیر اعصاب بینایی



# مسیر اعصاب بینایی و حوزه دید





# آسیب‌های اعصاب بینایی

Left visual field defects



1



2



3



4



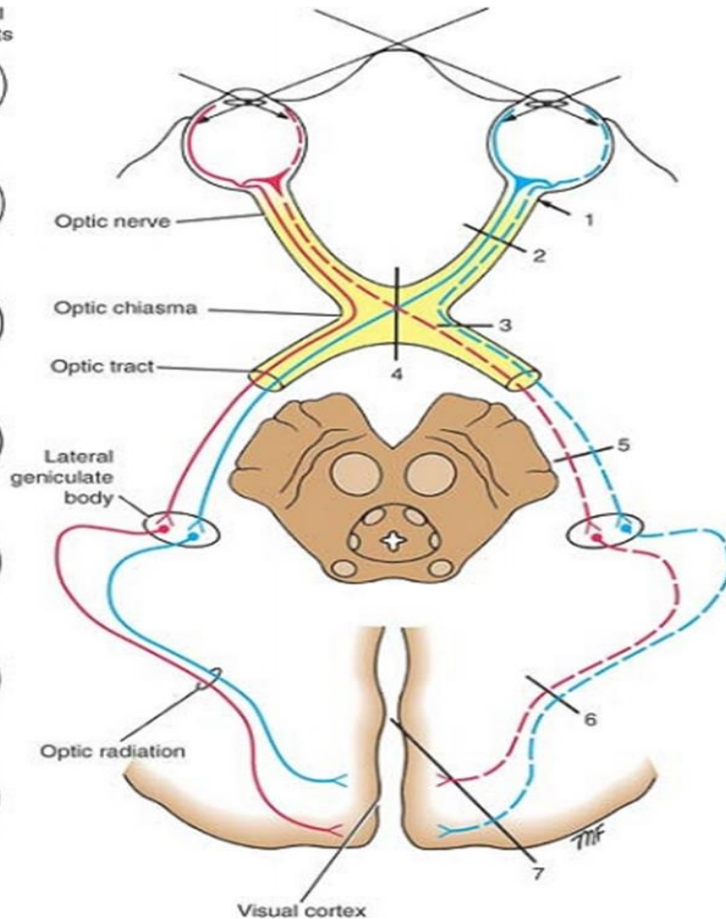
5



6



7



Right visual field defects



1



2



3



4



5



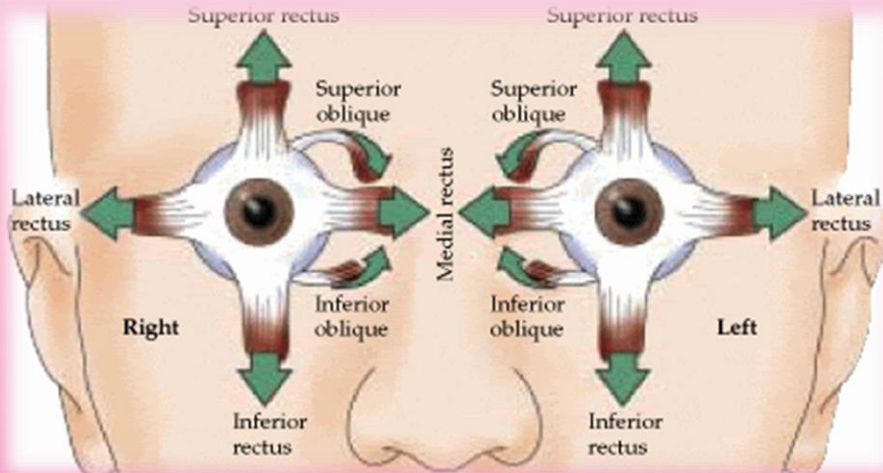
6



7

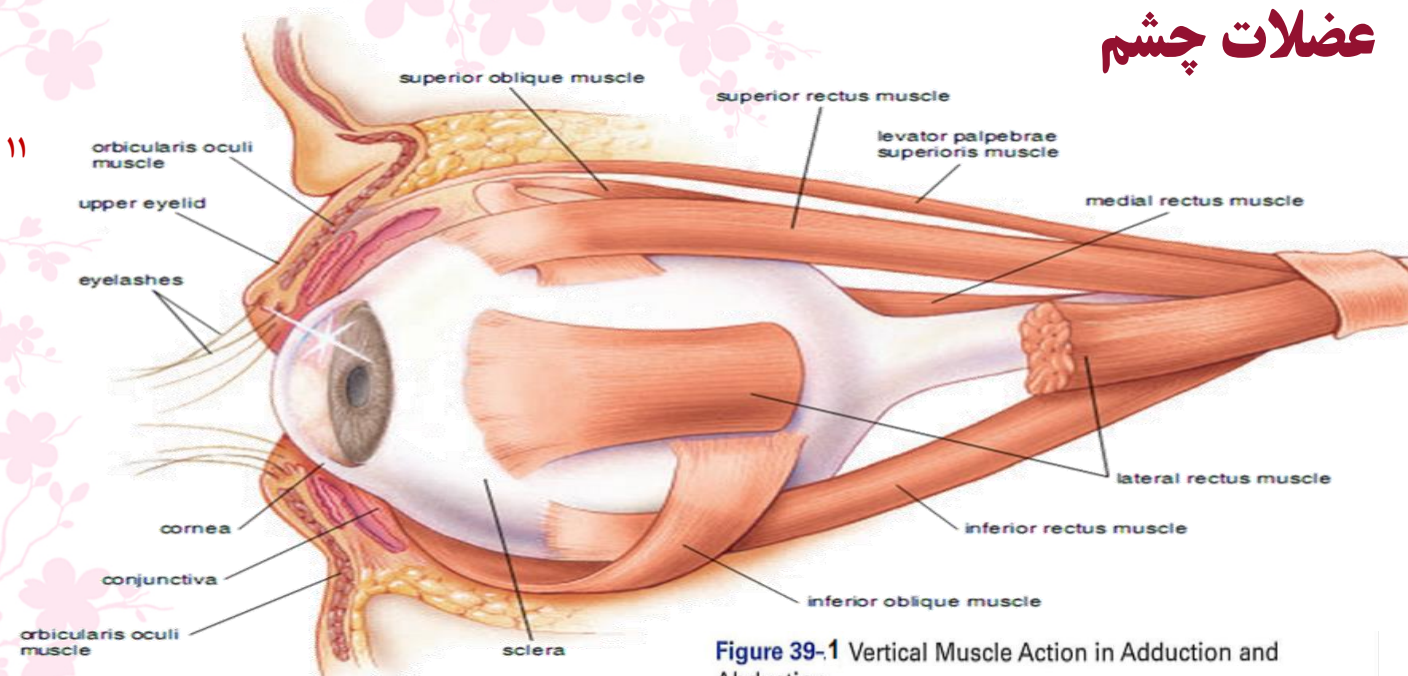
# فهرست مطالب:

- ✓ آناتومی چشم
- ✓ قشر بینایی و اعصاب چشم
- عضلات چشم ←
- حرکت‌های چشم
- مدل‌های حرکت چشم



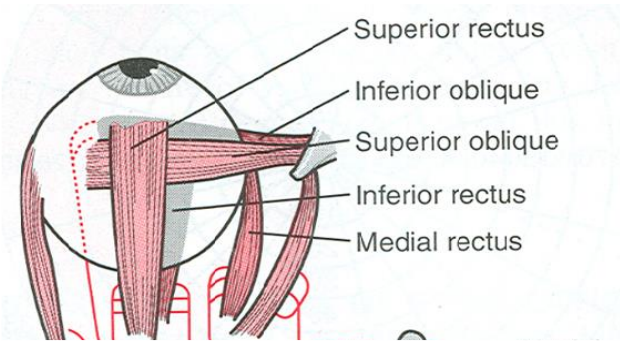
# عضلات چشم

11

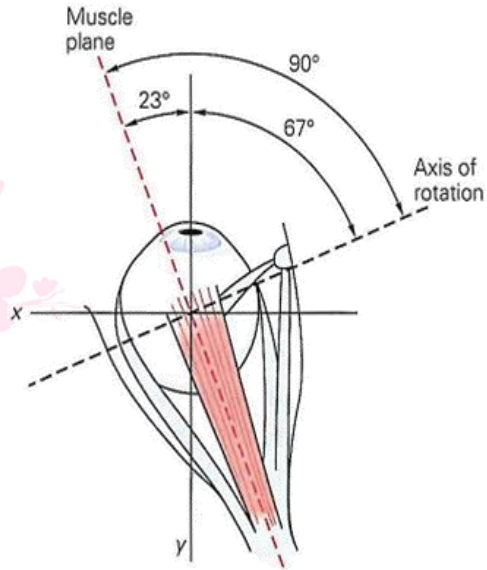


**Figure 39-1** Vertical Muscle Action in Adduction and Abduction

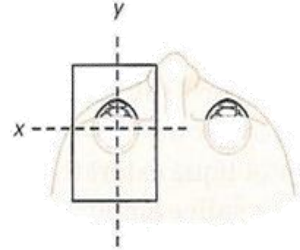
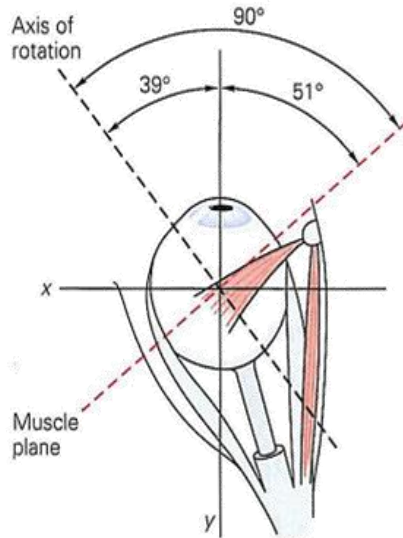
Muscle	Action in adduction	Action in abduction
Superior rectus	Intorsion	Elevation
Inferior rectus	Extorsion	Depression
Superior oblique	Depression	Intorsion
Inferior oblique	Elevation	Extorsion



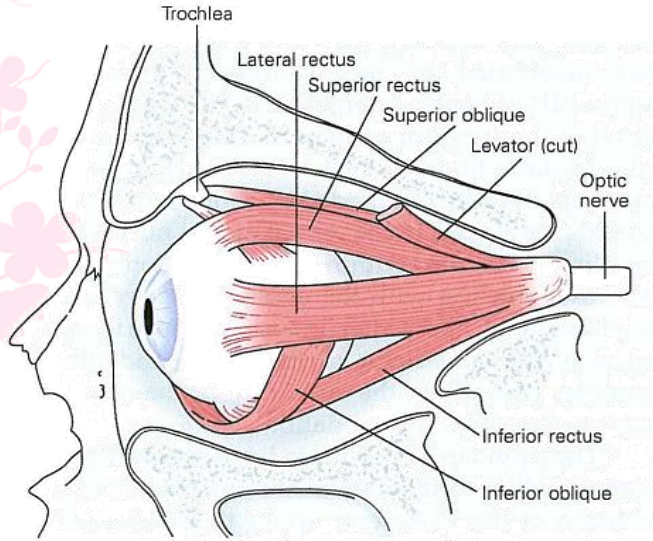
A Left superior rectus



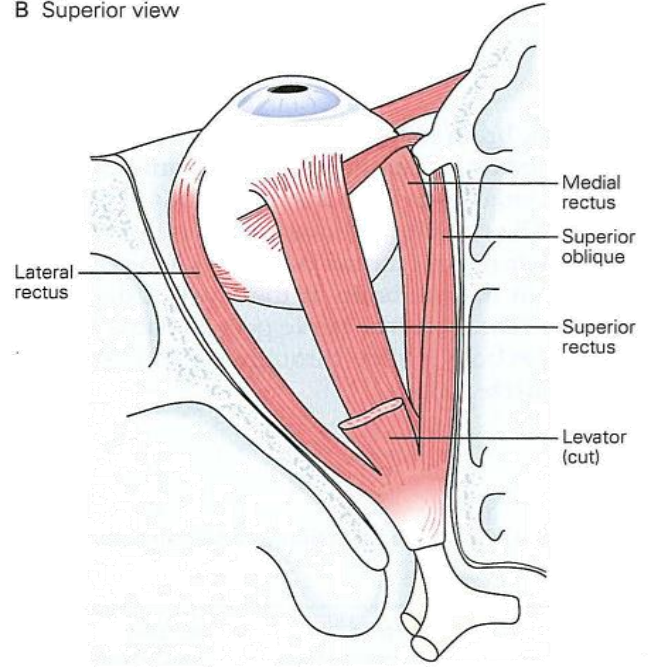
B Left superior oblique



A Lateral view



B Superior view





# فهرست مطالب:

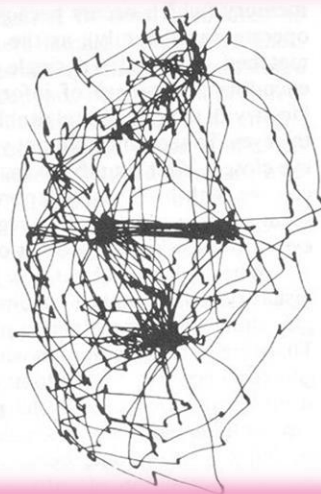
✓ آناتومی چشم

✓ قشر بینایی و اعصاب چشم

✓ عضلات چشم

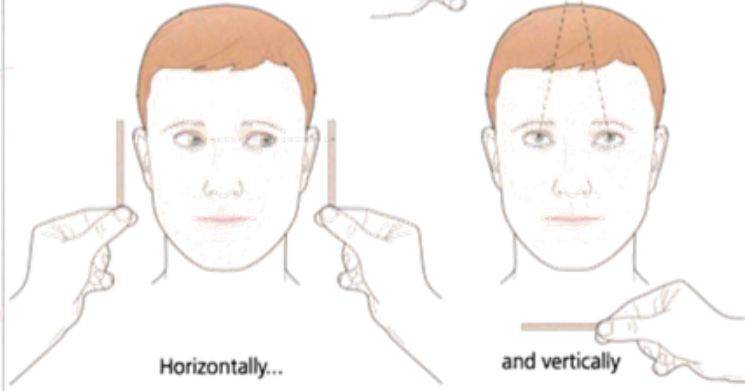
○ حرکت های چشم ←

○ مدل های حرکت چشم



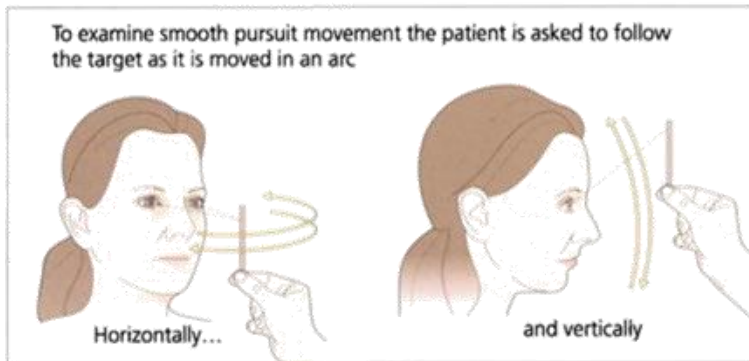
# حرکت‌های چشم

Saccades are examined by asking the patient to look from one target to another.



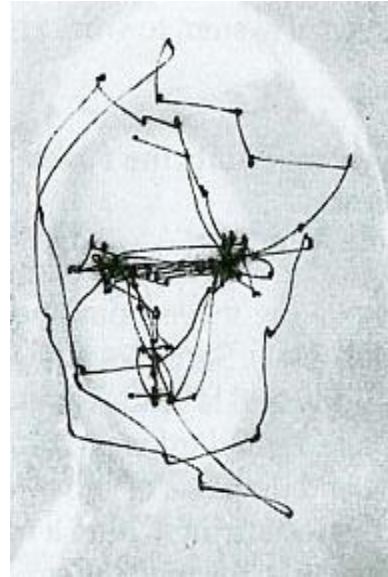
- حرکت saccade
- حرکت vergence
- حرکت smooth pursuit

To examine smooth pursuit movement the patient is asked to follow the target as it is moved in an arc



# حرکت سaccade

۱۶

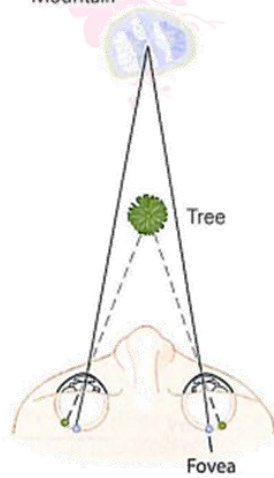


# حركات vergence

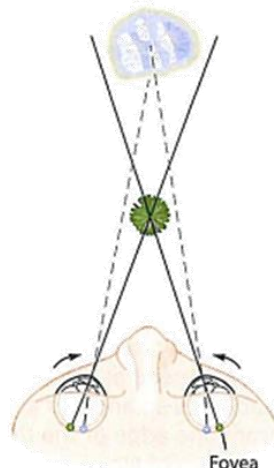
Focus on mountain



Mountain



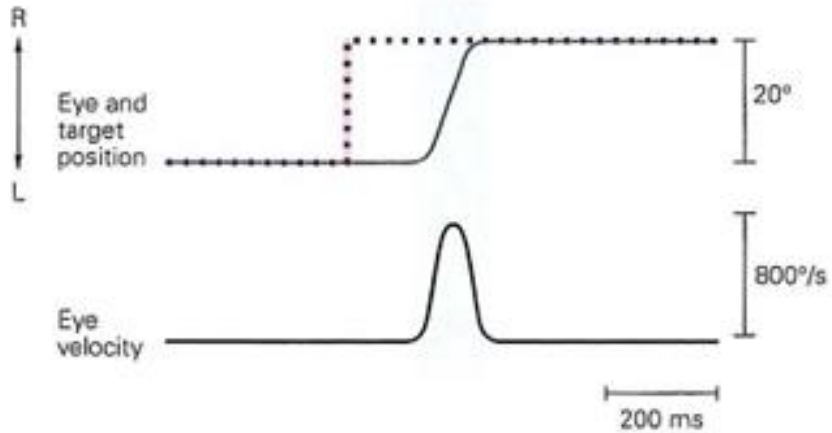
Focus on tree



# مشخصات حرکت ساکدیک

۱۸

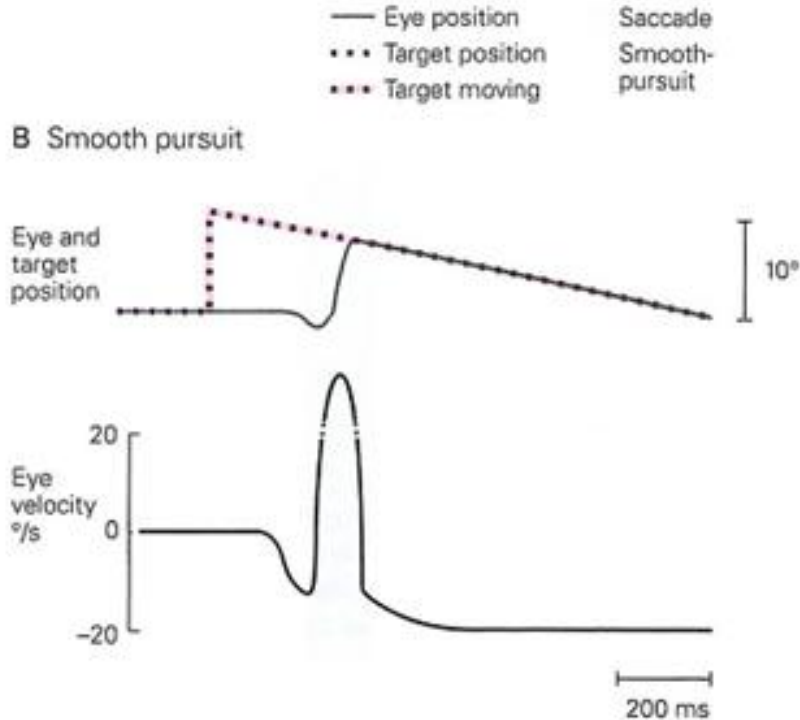
A Saccade





# مشخصات حرکت (saccade + حرکت smooth pursuit)

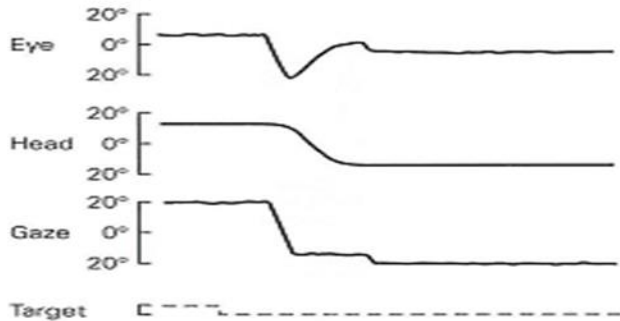
۱۹



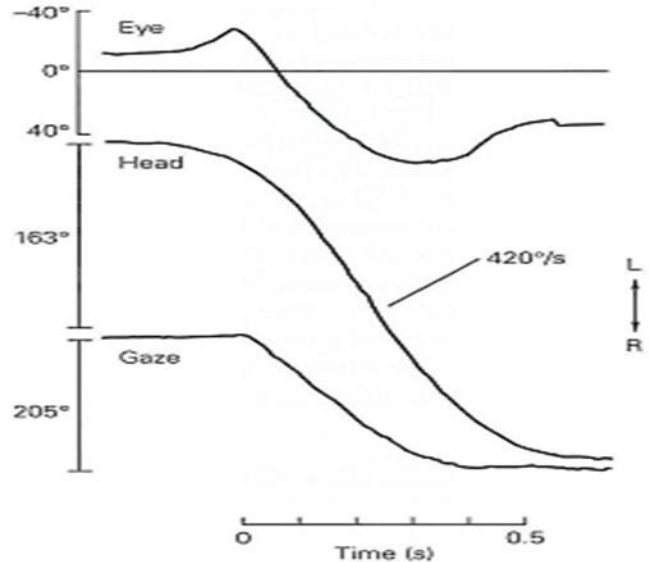
# جابجایی محل خیره شدن (gaze shift)

۲۰

**A Small gaze shift**

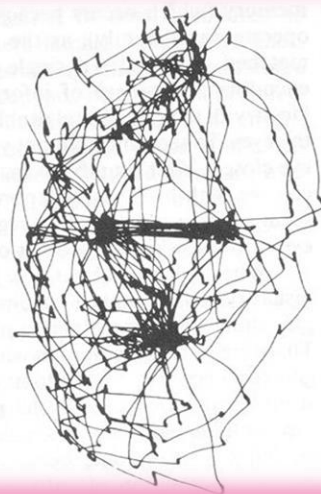


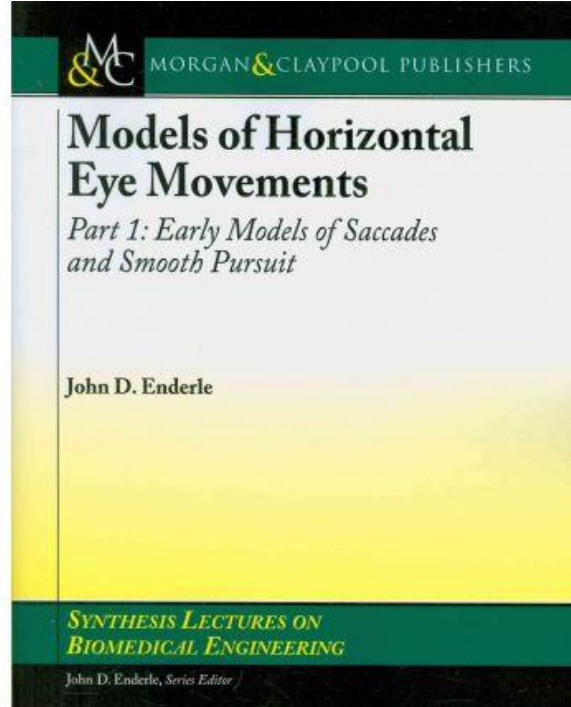
**B Large gaze shift**



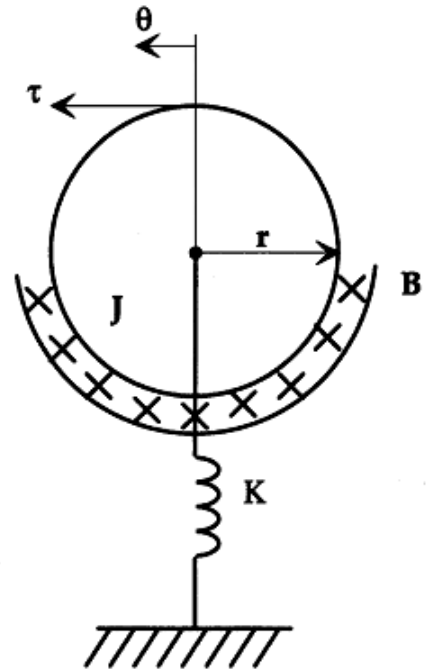
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- ✓ عضلات چشم
- ✓ حرکت های چشم
- مدل های حرکت چشم ←

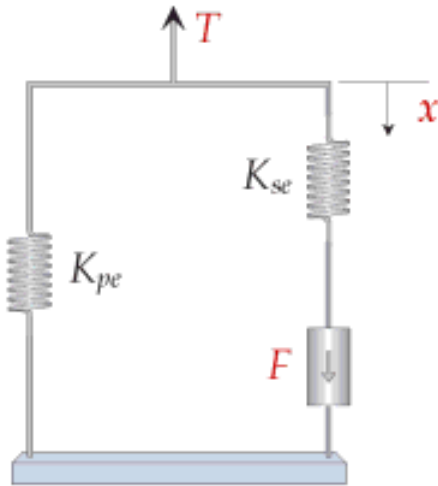




**FIGURE 166.2** A diagram illustrating Westheimer's [1954] second-order model of the saccade system. The parameters  $J$ ,  $B$ , and  $K$  are rotational elements for moment of inertia, friction, and stiffness, respectively, and represent the eyeball and its associated viscoelasticity. The torque applied to the eyeball by the lateral and medial rectus muscles is given by  $\tau(t)$ , and  $\theta$  is the angular eye position.







**Figure 3.12:** Diagram illustrating a muscle model consisting of an active state tension generator  $F$ , passive elastic element  $K_{pe}$ , and series elastic element  $K_{se}$ . Upon stimulation of the active state tension generator  $F$ , a tension  $T$  is exerted by the muscle.

# شماژیک مدل حرکت saccade در صفحه

۲۵

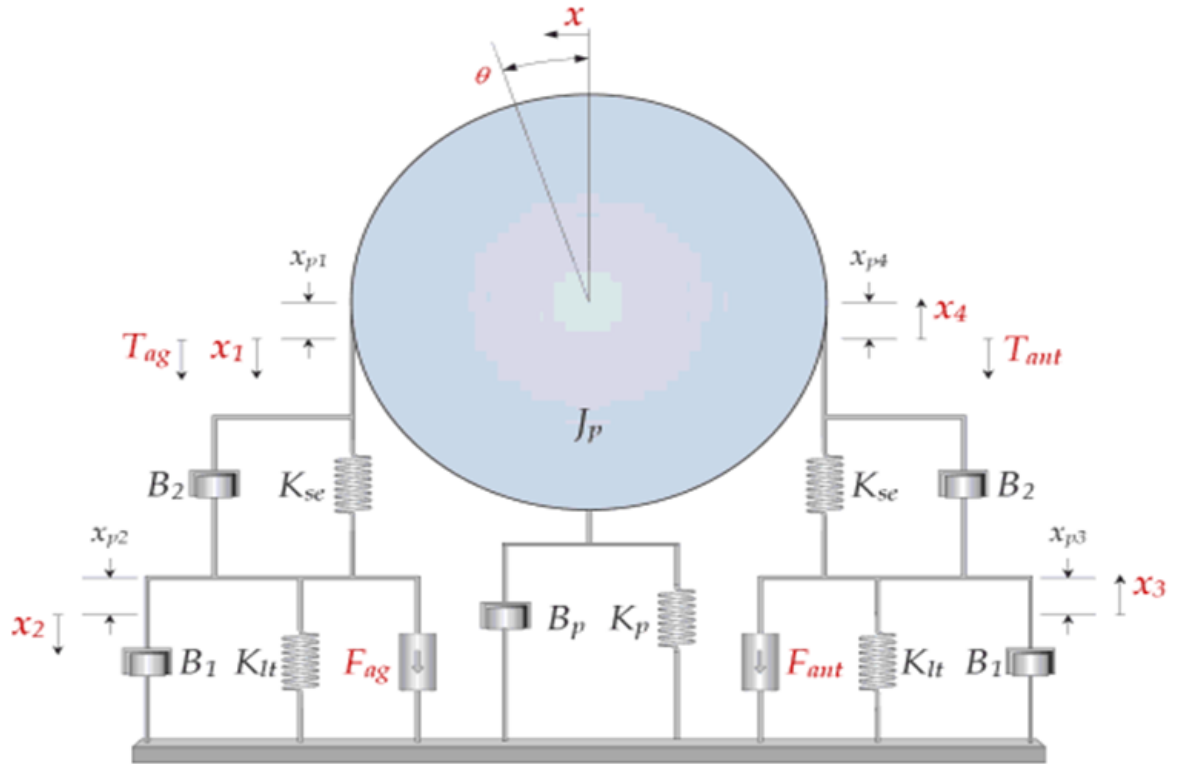


Figure 1.1: Oculomotor plant used for analyzing saccades with post-saccade behavior.

# نمودار بلوکی حرکت saccade چشم در صفحه

۲۶

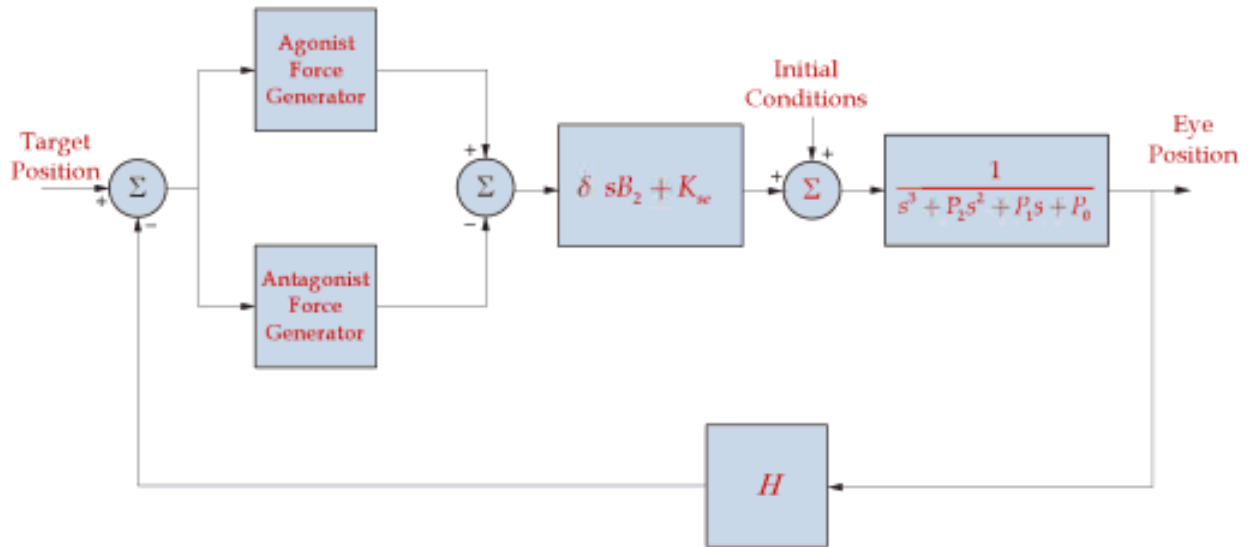
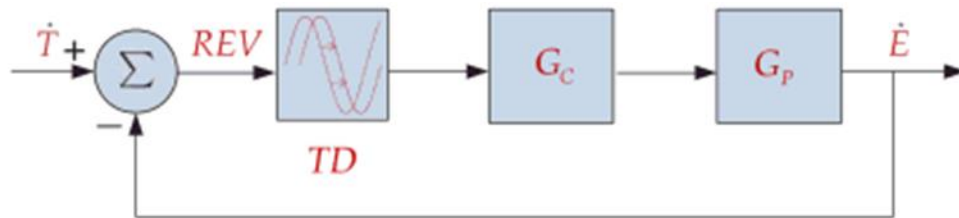


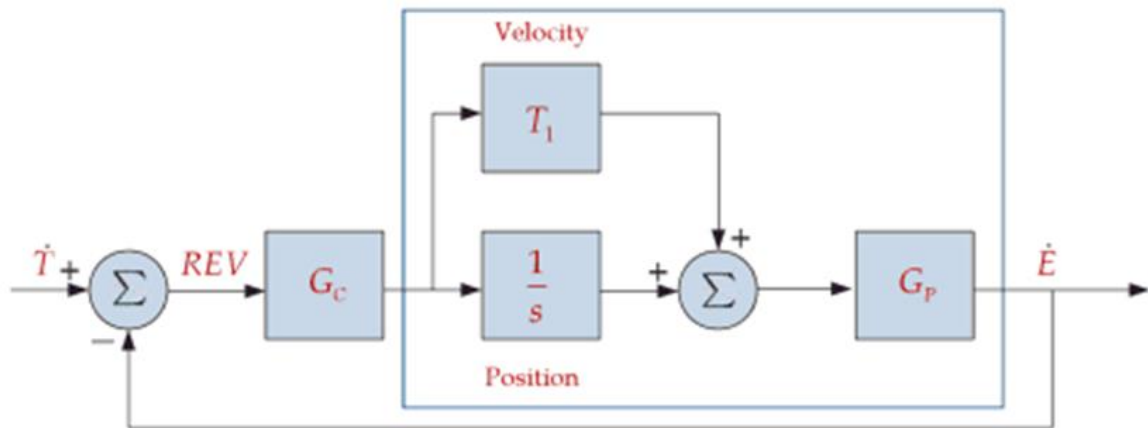
Figure 1.3: Block diagram of the 2009 linear homeomorphic saccadic eye movement model.

# نمودار بلوکی حرکت smooth pursuit

۲۷



**Figure 2.1:** Simple smooth pursuit feedback model. All functions and variables are functions of the Laplace variable  $s$ .



**Figure 2.7:** Simple smooth pursuit feedback model with retinal error position and velocity in the forward path.  $T_1 = 0.2$ .

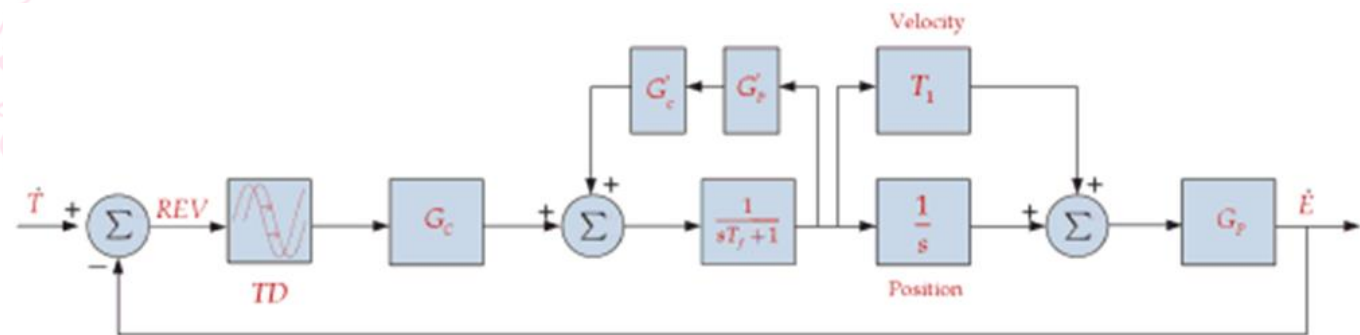
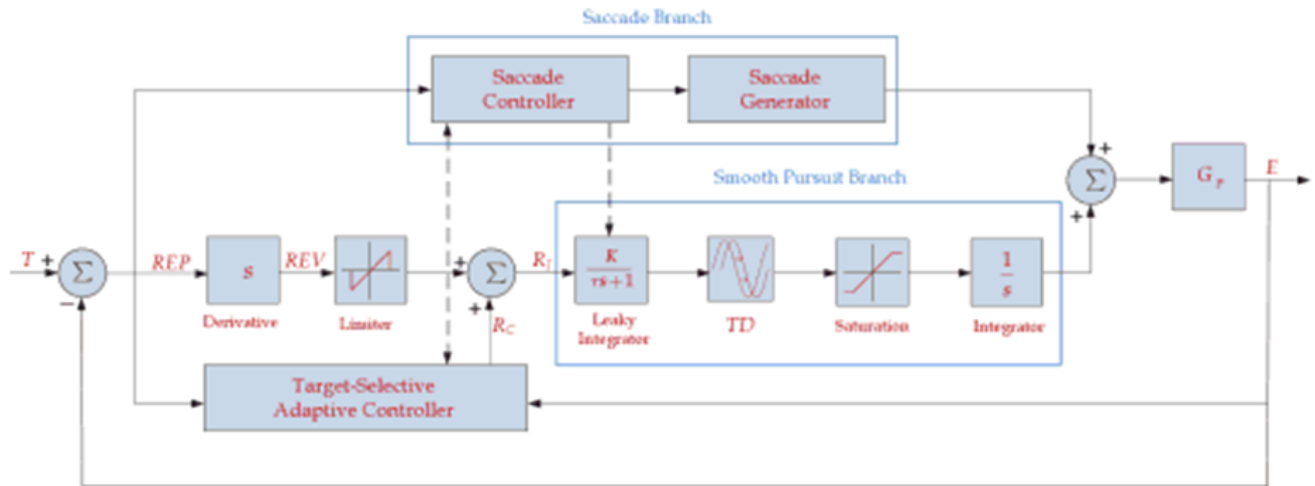


Figure 2.13: Smooth pursuit model loosely based on the one by Yasui and Young, 1975.



# کنترل تطبیقی انتخاب هدف

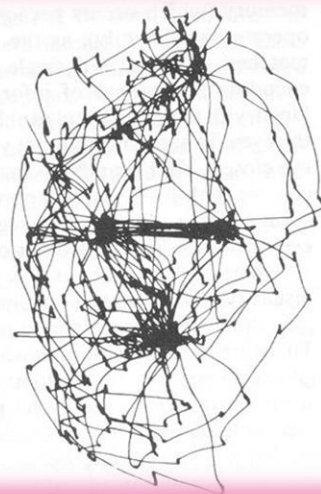
۳۰



**Figure 2.14:** Target-selective adaptive control model primarily based on Bahill and coworkers. The input is target position and the output is eye position. The smooth pursuit and saccade branches are enclosed in the blue boxes.

# فهرست مطالب:

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- ✓ عضلات چشم
- ✓ حرکت های چشم
- ✓ مدل های حرکت چشم



الهی!

من نه آنم که ز فیض نکمت چشم پوشم،

تو نه آنی که کدرا نوازی به مگای؛

در اگر باز نکرده، نروم باز به جایی؛

پشت دیوار نشینم، چو کدابر سر راهی؛

کس به غیر تو نخواهم، چه نخواهی چه نخواهی؛

باز کن در، که جز این خانه مرا نیست پناهی.